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DESIGN, FABRICATION, AND TESTING OF THE MAXIMUM PERFORMANCE EJE--ETC(U)
NOV 80 T J ZENOBI, W C WARD
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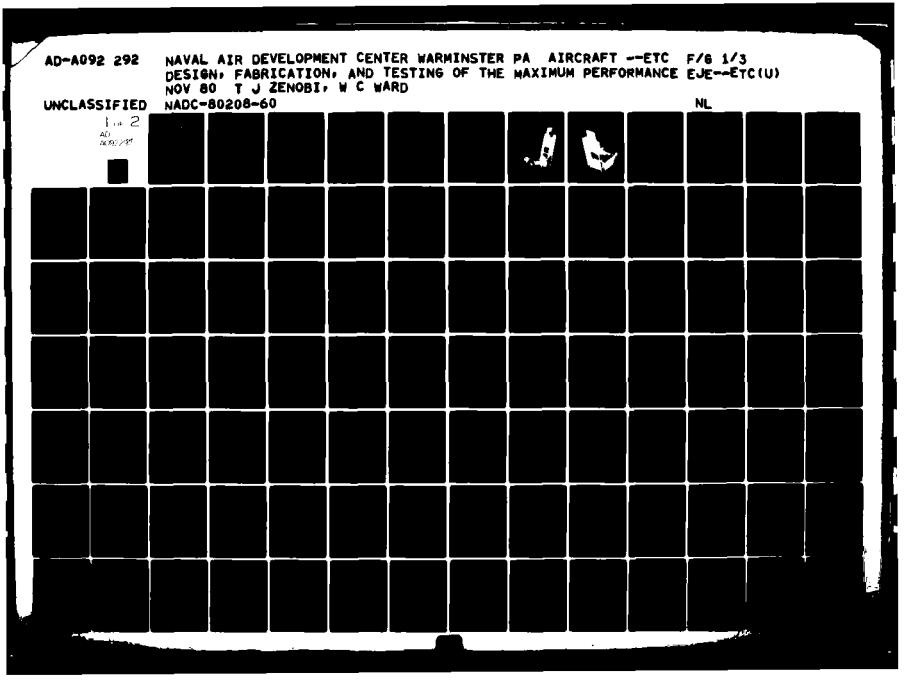

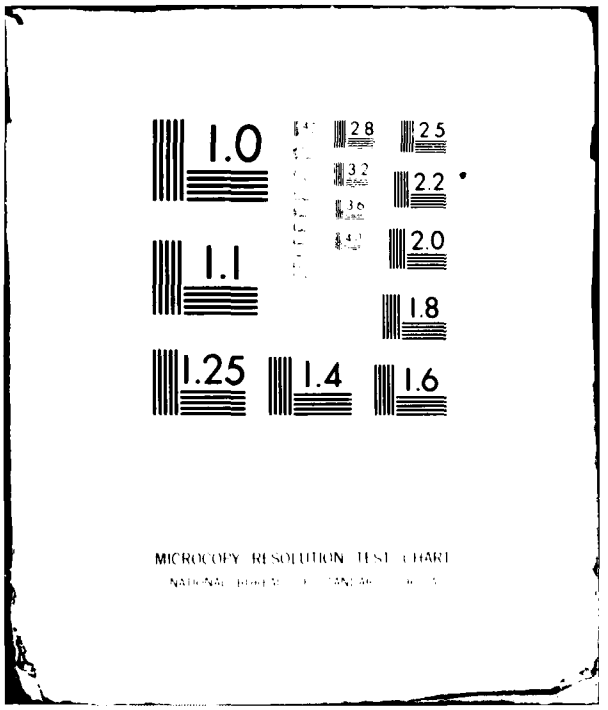
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MICROCOPY RESOLUTION TEST CHART

REPORT NO. NADC-80208-60

LEVEL II

AD A092292

DESIGN, FABRICATION, AND TESTING OF THE MAXIMUM PERFORMANCE EJECTION SYSTEM (MPES) SEAT STRUCTURE

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Warminster, Pennsylvania 18974

NOVEMBER 1980

PHASE REPORT

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Ejection Seats
Composite Structures

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Navy has undertaken an effort to utilize an ejection seat structure composed of aluminum honeycomb sandwich composite material. This report documents the design, fabrication procedures and acceptance testing of the seat structure. Due to higher fabrication costs, tradeoffs between strength, weight, and cost will have to be addressed.

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B A C K G R O U N D

During the past two years, the U.S. Navy, in an effort to improve aircrew safety, has undertaken an advanced development program entitled the Maximum Performance Ejection System (MPES). The system incorporates new technologies from a variety of engineering disciplines.

Currently, the MPES technology includes such subsystems as:

- Thrust vector control rocket
- Seat mounted torso restraint/parachute harness with a single point release
- Passive limb restraint
- Microprocessor controlled timing/sequencing
- Vacuum packed parachutes

The desire to incorporate thrust vector controlled propulsion requires allotment of a larger-than-standard volume under the MPES seat lid for placement of the rocket propulsion system. This condition forces the survival kit to be placed not under the seat lid, as is the standard location, but on the seat back of the seat structure. Thus, there is a unique backpack survival kit design being developed for MPES.

A P P R O A C H

All of the forementioned technologies affect the design of the basic seat structure.

The seat structure was designed to provide flat, unobstructed surface areas for ease of component/subsystem attachment. In order to offset the anticipated increased weight of the new technology prototype seat subsystems, especially the thrust vector controlled propulsion hardware, it was necessary to construct a lightweight seat structure.

In October 1980, a competitive contract (Contract No. N66269-80-C-0203) was awarded to Stencel Aero Engineering Co. for development of a seat structure constructed of reinforced aluminum honeycomb sandwich composite material. NADC provided the contractor with a dimensionalized seat configuration. Also, NADC provided the contractor with design loads and the expected points of application of these loads on the seat structure. Appendix A of this report lists the specified design loads. Based on NADC information the contractor was able to perform a detailed structural analysis and provide a detailed design for the MPES seat structure. The structural analysis and fabrication process is documented in Appendices B and C respectively. Photos of the manufactured seat structure are shown in Figures 1 and 2. Dimensional drawings of the structure are shown on pages 6-9 inclusive. Figure 6 shows the interface of the seat with the ejection guide rails. In order to distribute forward crash load forces over a large portion of the seat, the guide rails have been designed as a long continuous interfacing set of rails. The seat slides up the cockpit-mounted rails upon ejection. The rails are coated with a baked on molybdenum disulfide coating predicted to yield a sliding coefficient of friction of about 0.03 to 0.04.

The seat structure is designed with structural inserts at areas required

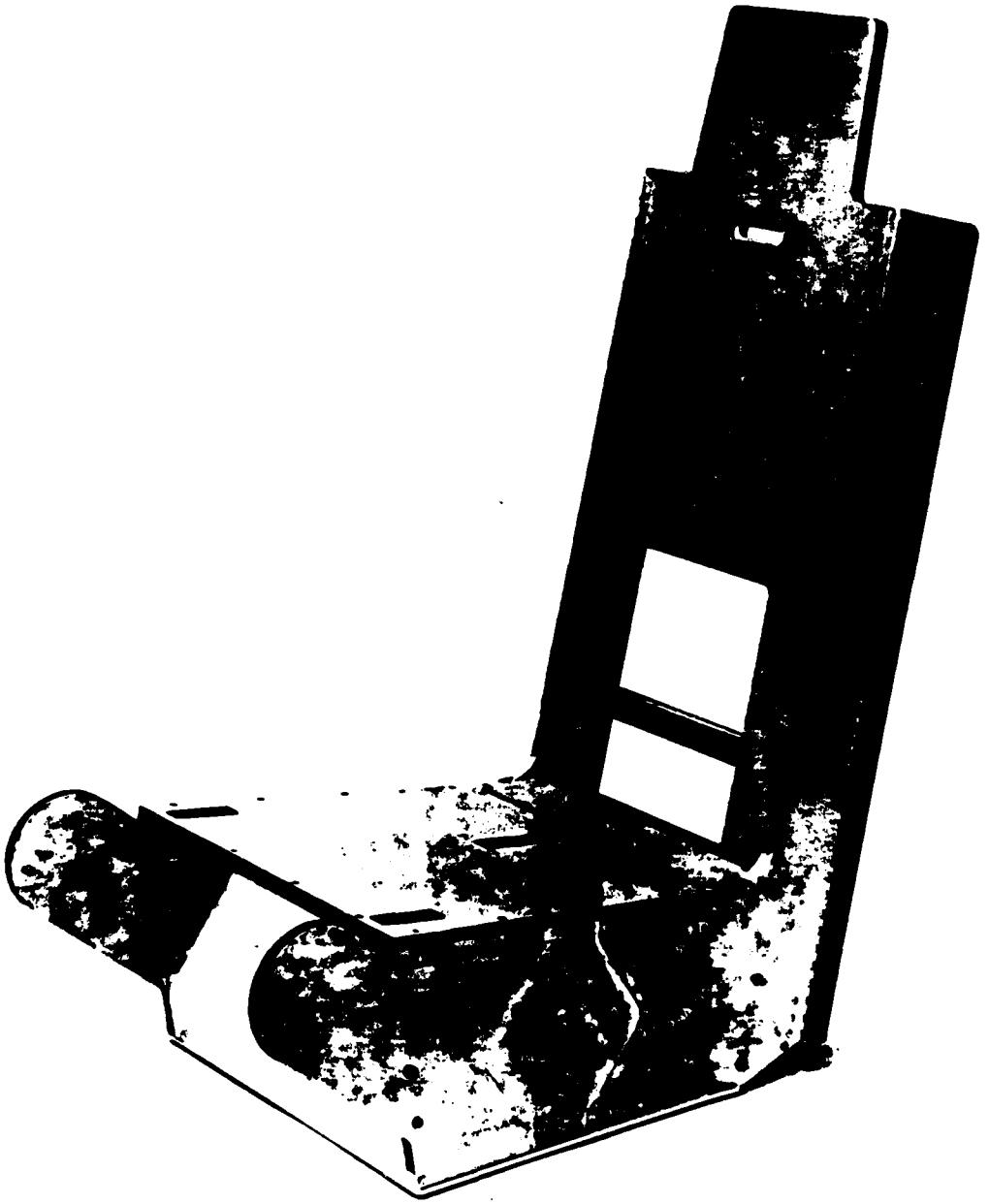


Figure 1- MPES Seat Structure

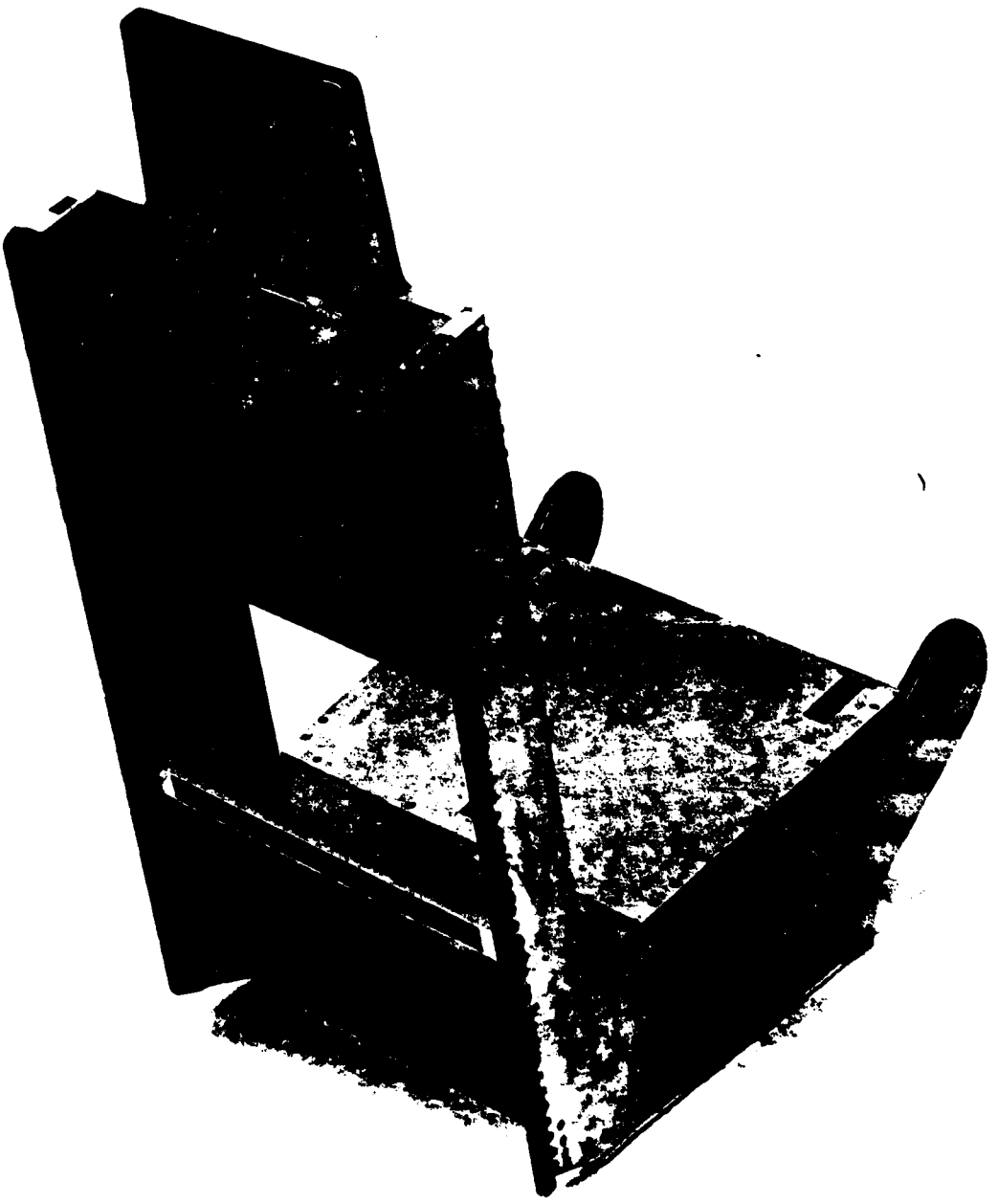


Figure 2- MPES Seat Structure (Rear View)

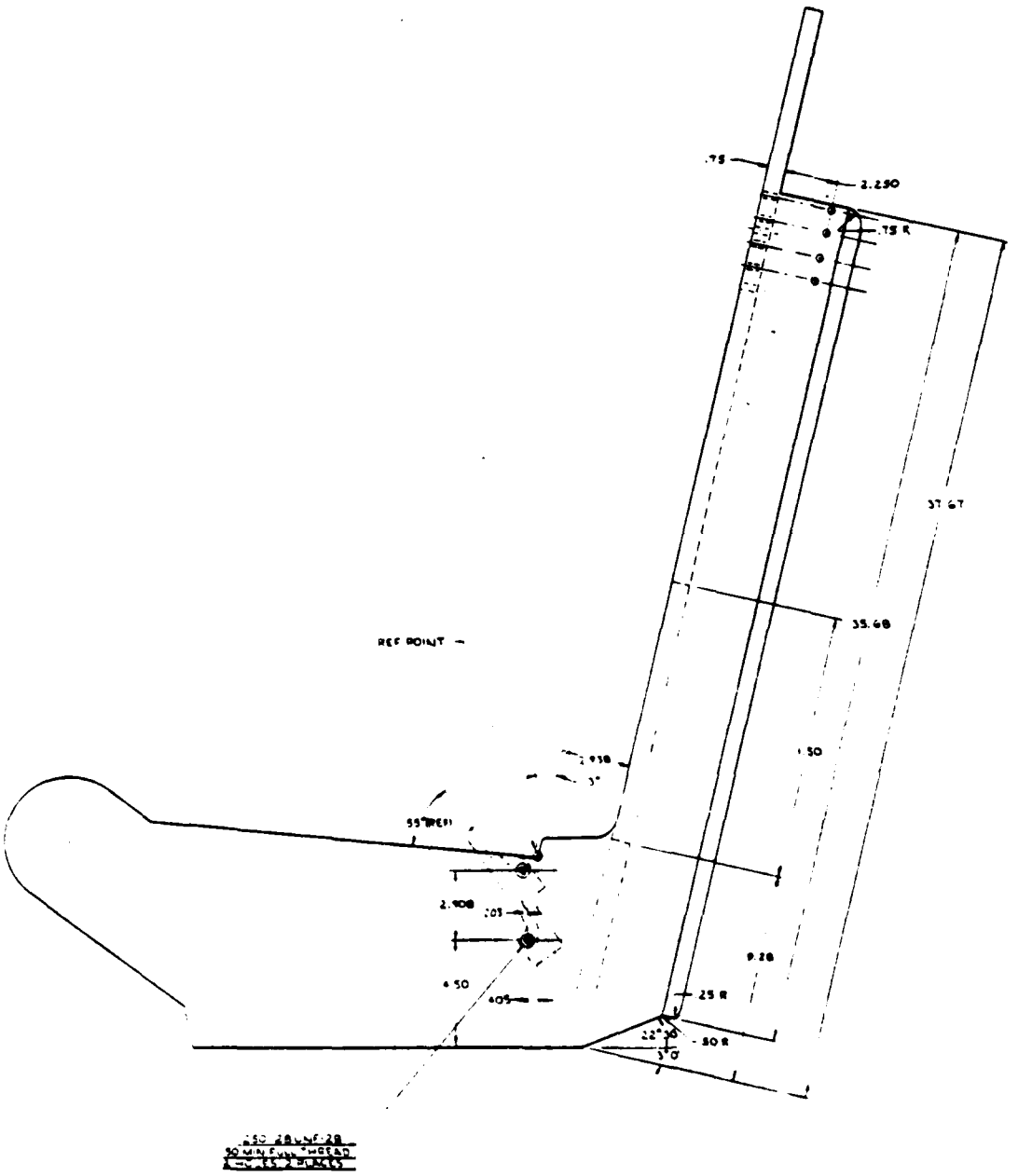


Figure 3- Dimensionalized Drawing of MPES Seat Structure (Side View)

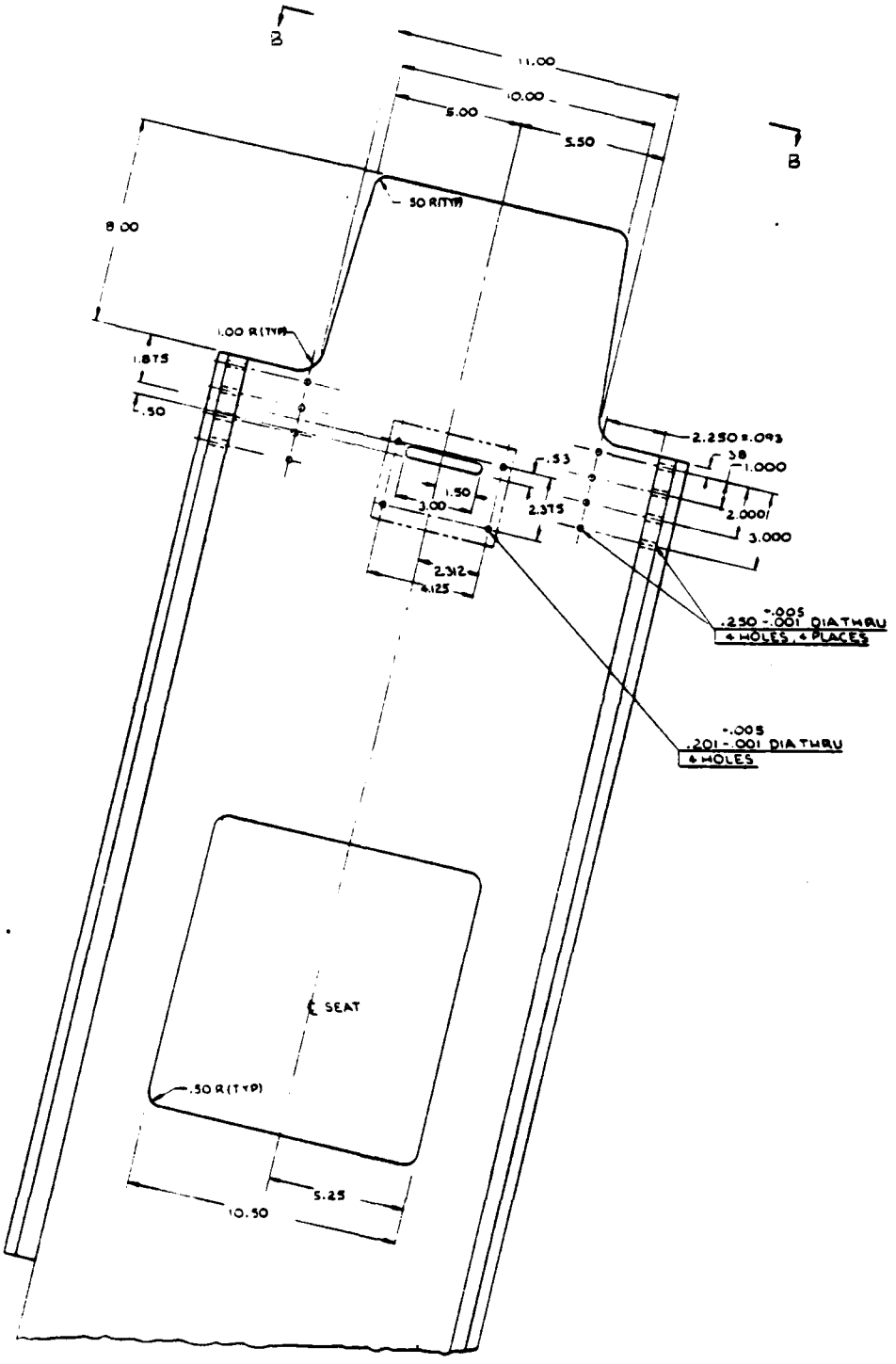
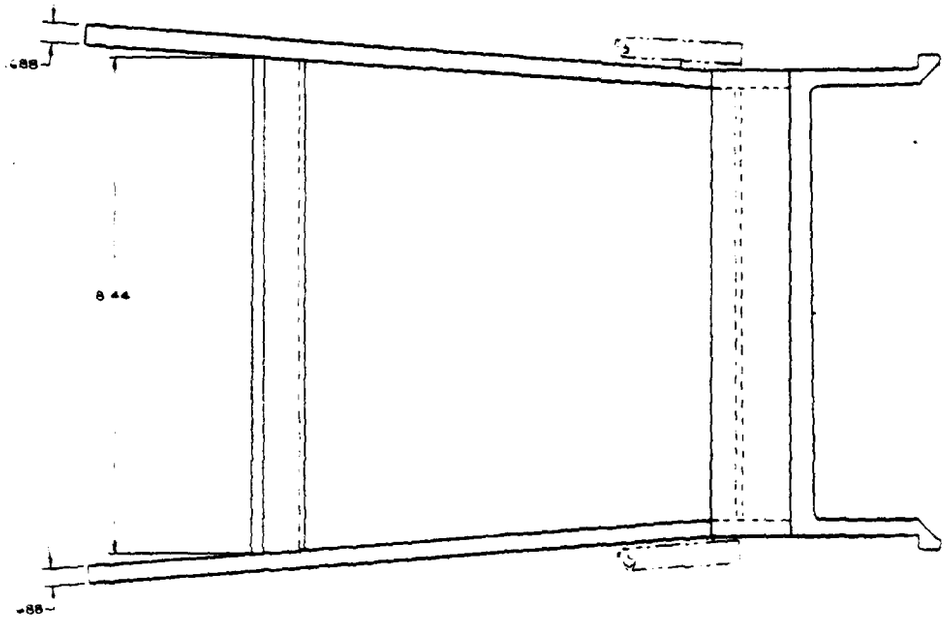


Figure 4- Dimensionalized Drawing of MPES Seat Structure
(Rear View)



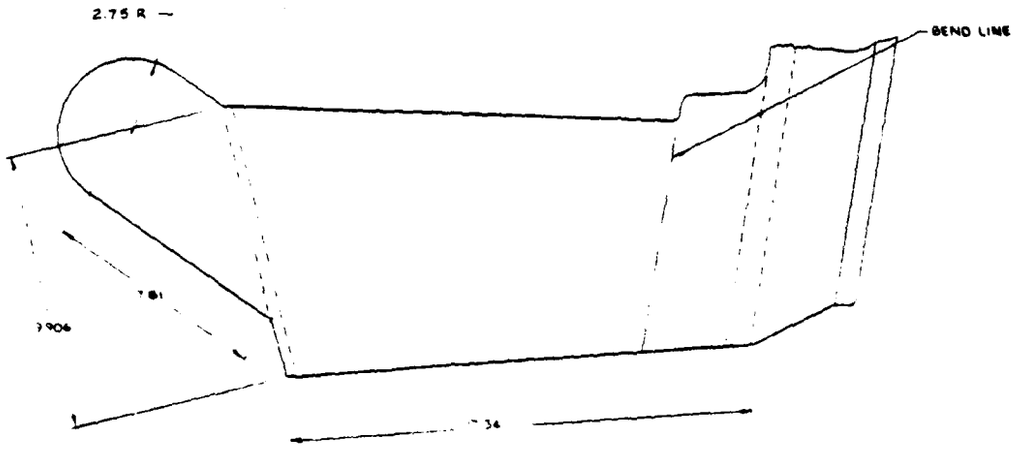


Figure 5- Dimensionalized Drawing of MPES Seat Structure (Seat Bucket)

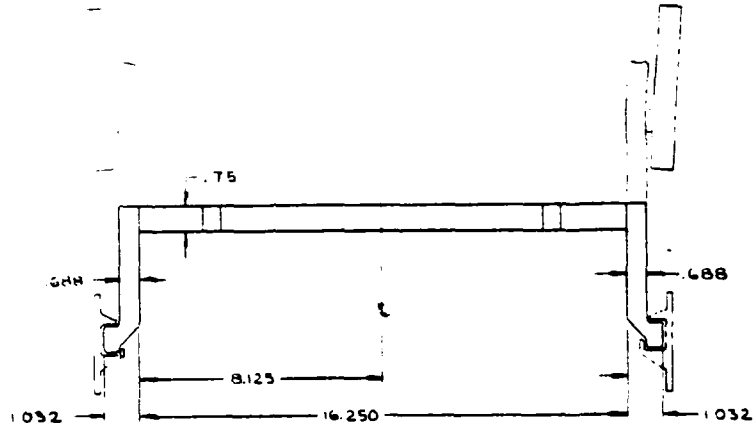


Figure 6- Dimensionalized Drawing of MPES Seat Structure
(Guide Rail Interface)

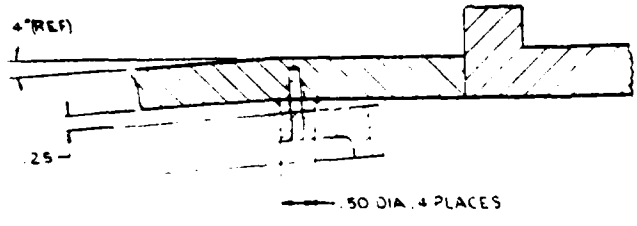


Figure 7- Dimensionalized Drawing of MPES Seat Structure
(Lap Belt Attachment)

to react the specified design loads. At these areas various components and fittings which must also withstand the design loads are mounted. The seat will have other components attached to it in areas where loads are minimal. In these areas the loads will be transmitted into honeycomb sandwich material. Thus, the face sheets must react these loads. The recommended method for fastening the low-load bearing components to the honeycomb sandwich construction is essentially to use methods which prevent high local compressive stresses on the honeycomb core due to fastener tightening. One method is to provide a load distribution plate on each side of the honeycomb sandwich construction as a means of distributing the local compressive stress over a larger area. Another method is to use special commercial inserts which are "potted" into the honeycomb; these inserts are essentially of tubular construction, and the compressive loads due to fastener tightening act on the insert and not on the honeycomb.

After receiving the seat structures from the contractor, NADC performed dynamic structural tests on the seats. These tests are described in Appendix D. The loads imposed on the seats during these tests were somewhat less than the design loads; however, they were severe enough to represent any loads which the seat structures may experience during the current phase of the MPES development program. Examination of the seats, after the tests, showed no evidence of material failure. Hence, the seat structures were accepted by NADC and will be used for various system and subsystem tests during the current advanced development program.

C O N C L U S I O N

The aluminum honeycomb seat structure should provide a seat with structural integrity and low weight. However, it must be stated that the production cost, especially for low quantity production, is significantly more expensive than for seat structures composed of plate material (assuming cost is the only factor being considered). It is believed that costs can be reduced with further refinements and simplification of the overall ejection system design. Of course, the refinement and simplification of the seat structure is heavily influenced by the development of attached ejection seat subsystems and components, and by the importance placed on such factors as weight and maintainability.

A P P E N D I X A

MPES
SEAT STRUCTURE
DESIGN LOADS

INERTIA REEL LOADS (5,000 lbs.)

Loads based on 40 G forward sled tests. Approximately 2,500 lbs. tension on each inertia reel strap.

LAB BELT LOADS (6,000 lbs. on each side)

Loads based on 40 G forward sled tests.

DOWNWARD CRASH LOAD, CATAPULT ATTACHMENT FITTINGS (9,750 lbs./fitting)

Entire weight of ejection seat and most of crewman weight is supported by catapult system. Loads transmitted through catapult attachment fittings approximated to be:

(40g x seat weight) + (55g x weight of 98% crewman) or (40 x 170 lbs) + (55 x 230) = 19,450 lbs. or, for design purposes, 19,500 lbs. (assumed to be distributed evenly on two catapult attachment fittings).

WINDBLAST LOADS (1,844 lbs./sq.ft.)

Based on velocity of 660 knots at sea level (compressible flow). Drag coefficient, C_D, will be assumed to be approximately 1.

PARACHUTE/SEAT RELEASE FITTING LOAD (8,000 lbs. pull on seat back)

Based on estimate received from National Parachute Test Range.

HEAVY COMPONENT ATTACHMENT LOADS

Heavy components to be considered for 40 G loads include:

Parachute Package - 22 lbs.
Rocket Motors - 20 lbs.
Survival Kit - 8 lbs.

ROCKET THRUST VECTOR CONTROL REACTIONS WITHIN SEAT BUCKET

Seat/rocket interface structure must counteract approximately 3,500 lbs. thrust.

Thrust vector control actuators mounted on floor of seat bucket will impart shear loads (along floor) of approximately 1,000 lbs.

CREWMAN LOAD ON SEAT (12,650 lbs. distributed over seat lid)

Load for downward 40 G crash condition - 55 G dynamic response assumed, that is:

(55g x weight of 98% crewman) = 55 x 230 = 12,600 lbs.

A P P E N D I X B

MPES
SEAT STRUCTURE
STRUCTURAL ANALYSIS

Introduction

This report presents final structural analysis of the MPES (Maximum Performance Ejection Seat) bucket structure. This is in response to paragraphs 3.7 and 4.0 (page 16) of Statement of Work No. 639-2662 as given in Document No. N62269-79-R-0712. (Reference 1)

Discussion

Design Description

The seat bucket structure as discussed in this report consists of two side panels, a back panel, a front panel, a rest panel, a seat panel support channel, and two guide rails. The panels are of aluminum honeycomb sandwich construction with aluminum framing and inserts. The sandwich construction consists of 7075-T6 aluminum alloy face sheets and doublers (with the exception of the front panel which has 2024-T4 aluminum alloy face sheets), and 5056 aluminum alloy hexagonal honeycomb core. The framing, inserts, support channel and guide rails are 7075-T6 aluminum alloy, with the exception of the seat panel inserts which are 7075-T73 aluminum alloy.

Design Basis and Analysis Criteria

The seat bucket was designed to withstand the loads specified in Addendum A to Statement of Work No. 639-2662 as given in Document No. N62269-79-R-0712. In addition to these specified loads a leg impact load due to windblast during high speed ejection was considered. The structure was analyzed for ultimate loads with the following criteria:

1- Stress in the face sheets of the honeycomb sandwich panels should not exceed yield stress.
2- Honeycomb shear and compressive stress should not exceed the manufacturer's minimum strength values.
3- Buckling of the honeycomb sandwich panels should not occur.
4- Tensile, compressive, shear and bearing stresses in the framing, inserts, support channel and guide rails should not exceed ultimate values.

The structure was not analyzed for limit loads, since for the materials and criteria used these would be less critical than the ultimate loads. Allowable stress values and analysis methods are documented in Reference 2.

Results of Analysis

Margins of safety (MS) against ultimate loads were obtained. The detailed analysis is presented in the Appendix. The minimum margins of safety (and all negative margins of safety) for each structural component are given in Table I. The negative margins of safety are judged to be acceptable for the following reasons:

1) Side panels - The -.05 margin of safety for core shear due to leg impact is based on a 3000 LB impact load. Since this is an unspecified condition and the assumed magnitude of the load is probably

conservative, this margin of safety is judged to be acceptable. The -.01 margin of safety due to the parachute extraction line load, is probably very conservative because part of this load will be reacted by the shoulder harness straps.

2) Seat Panel - The -.25 margin of safety for core shear due to the 40G downward crash load is based on minimum core shear strength values. Based on typical shear strength values this margin of safety is -.09. In view of the conservatism of the analysis, no design changes are planned pending test results.

3) Guide Rails - The -.10 margin of safety for fastener shear is due to windblast at ejection tip-off. Because of the very brief duration of the load and the conservatism of the analysis, this margin of safety is judged to be acceptable.

4) Back Panel - The -.04 margin of safety for bending and torsion in the upper insert arises from the parachute extraction line load. The analysis is conservative because some of this load will be reacted by the shoulder harness straps.

TABLE B-I MARGINS OF SAFETY

ITEM	DRAWING NO.	PAGE	MARGIN OF SAFETY	CRITICAL MODE	LOAD CONDITION
SIDE PANELS	16120		.03	BENDING STRESS IN FACE SHEETS	DOWNWARD CRASH LOAD
			-.05	CORE SHEAR	LEG IMPACT LOAD
			-.01	BENDING STRESS & BUCKLING OF FACE SHEETS	PARACHUTE EXTRACTION LINE LOAD
FRONT PANEL	16160		.15	CORE SHEAR	DOWNWARD CRASH LOAD
SEAT PANEL	16130		-.25	CORE SHEAR	DOWNWARD CRASH LOAD
SUPPORT CHANNEL	16181		.15	BENDING	DOWNWARD CRASH LOAD
GUIDE RAILS	16200		-.10	FASTENER SHEAR	WINDBLAST - TIP-UP
BACK PANEL	16110		-.04	BENDING & TORSION IN THE UPPER INSERT	PARACHUTE EXTRACTION LINE LOAD

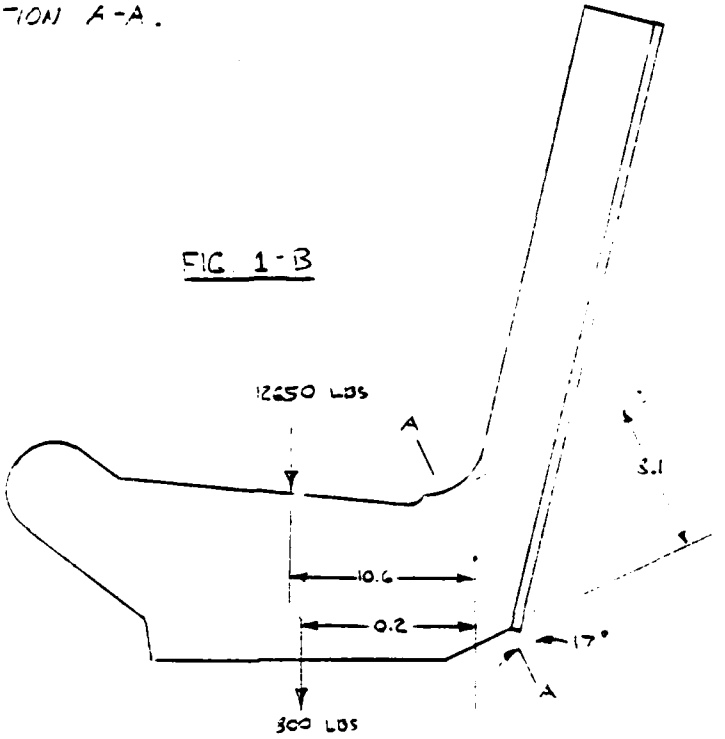
WPEC

SIDE PANELS - DOWNWARD CRASH LOAD

DWG 16120

CRITICAL SECTION WILL BE SECTION A-A.

FIG 1-B



M = (12250 LBS)(10.6 IN) + (300 LBS)(10.2 IN) = 132350 IN-LBS

V = (12250 LBS + 300 LBS) COS 17° = 12362 LBS

P = (12250 LBS + 300 LBS) SIN 17° = 3932 LBS (TENSION)

FACE SHEET MATERIAL - 7075-T6 F_{tu} = 76 KSI, F_{cu} = 67 KSI, F_{su} = 46 KSI

SECTION PROPERTIES: CONSERVATIVELY NEGLECT THE FRAME (MAY OR MAY NOT BE EFFECTIVE)

$$A = \frac{\pi}{4}(.500)^2 - \frac{\pi}{4}(.032)^2 = .188 \text{ IN}^2$$

$$I = \frac{\frac{\pi}{4}(.032)^2}{2}\left(\frac{.5}{2}\right)^2 = 2.21 \text{ IN}^4$$

DWG 16 20

$$\sigma_c = \frac{Mc}{I} = \frac{42250(4.05)}{9.21} = 62600 \text{ psi}$$

$$\sigma_t = \frac{P}{A} = \frac{3432}{1.65} = 2040 \text{ psi}$$

$$M.S.\ (\text{AGAINST YIELD}) = \frac{67}{62.6 - 2.04} - 1 = \underline{0.03}$$

CHECK FLEXURAL SHEAR : $\tau = \frac{VQ}{It}$

$$\text{AT THE N/A} : Q = \underbrace{2(.032)(.32)}_{=.208}\left(\frac{4.1}{2}\right) = 1.75$$

$$\tau = \frac{2832(1.75)}{9.2(.208)} = 800 \text{ psi}$$

$$M.S.\ (\text{SHEAR}) = \frac{46}{11.8} - 1 = \underline{2.9}$$

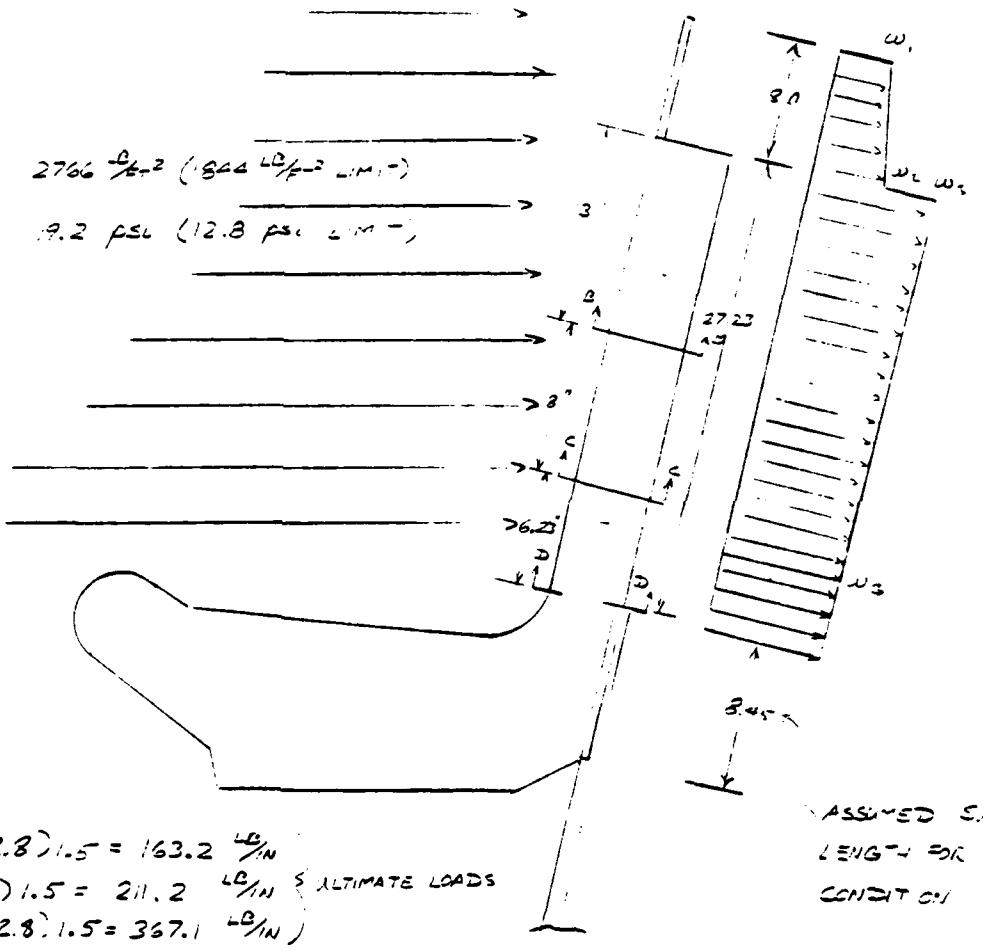
7

MODS

SIDE PANELS (CONT'D)

DWG 16120

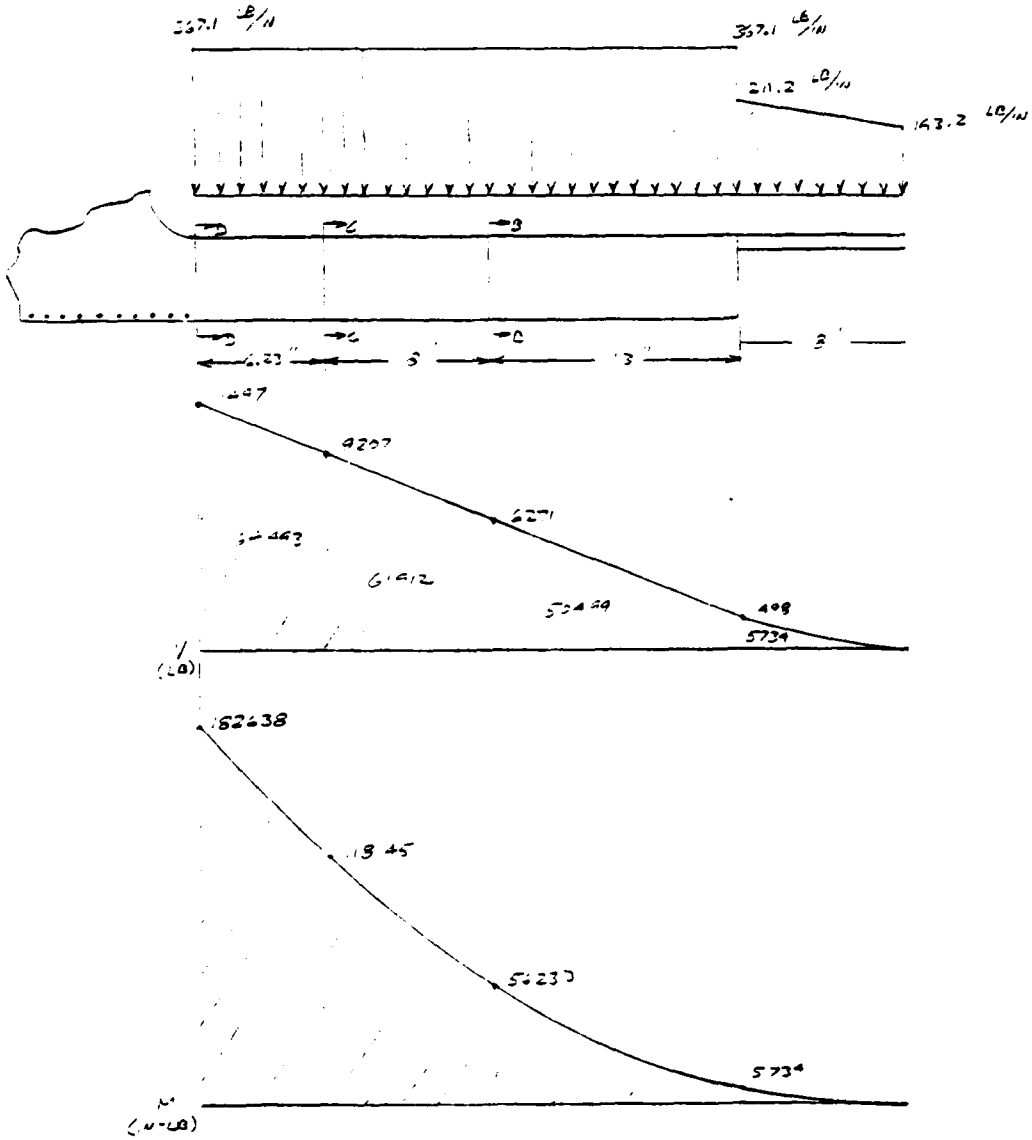
CRITICAL LOADING FOR THE UPPER PORTION WILL BE DUE TO WINDBLAST AT TAKEOFF



$w_1 = (8.5)(12.8)1.5 = 163.2$ LB/IN
$w_2 = (11)(12.8)1.5 = 211.2$ LB/IN } ULTIMATE LOADS
$w_3 = (19.12)(12.8)1.5 = 367.1$ LB/IN

BY INSPECTION, SECTIONS B-B, C-C, AND D-D WILL BE CRITICAL.

DWG. 6 CD

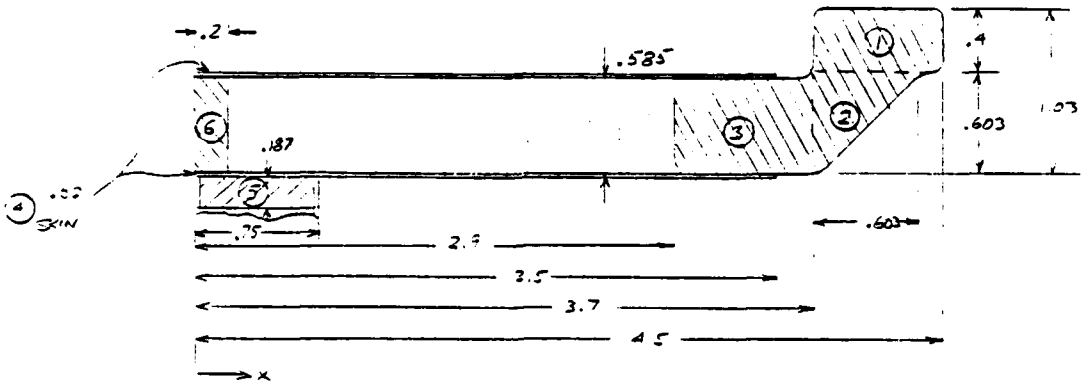


NOTE: THESE ARE TOTAL LOADS FOR ONE SIDE PANEL. THESE MUST BE DIVIDED BY TWO.

DWG. 15 20

SECTION B-L :

SECTION PROPERTIES



ELEM.	AREA	x	Ax	I_x'	$A(x-\bar{x})^2$
①	.320	4.1	1.312	.0171	.5080
②	.182	3.90	.710	.0037	.2045
③	.468	3.30	1.544	.0250	.0990
④	.40	1.75	.245	.1429	.1663
⑤	.40	.375	.054	.0066	.8507
⑥	.017	.100	.012	.0004	.8784
Σ	1.367		3.877	.1957	2.7069

$$\bar{x} = \frac{\Sigma Ax}{\Sigma A} = \frac{3.877}{1.367} = 2.84 \text{ IN}$$

$$I = \Sigma (I_x' - A(x-\bar{x})^2) = 2.90 \text{ IN}^4$$

LOADS: $M = 56,200/2 = 28100$ IN-LB

$V = 607/2 = 3'40$ LB

BENDING: $\sigma_c = \frac{Mc}{I} = \frac{28100(2.84)}{2.90} = 27500$ psi

M.S. (AGAINST YIELD) = $\frac{55}{55} - 1 = .00$

DWG. 16-20

SHEAR: AT THE NEUTRAL AXIS - $\tau = \frac{VQ}{It}$

$Q = .7(2.64 - .) - .4(2.64 - .375) - .02(2)(2.64)^2/2 = 0.827\ in^3$

$\tau = \frac{3.40(.827)}{2.90(2)(.02)} = 22,400\ psi$

$M.S.\ (SHEAR) = \frac{46}{22.4} - 1 = \underline{1.05}$

SECTION C-C:

SECTION PROPERTIES: SAME AS SECT B-B EXCEPT THAT ELEMENT ⑥ IS .45" THICK

ELEM. #	AREA	x	A_x	I_x'	$A(x-\bar{x})^2$
①	.32	4.1	1.312	.0171	.7092
②	.182	3.90	.710	.0037	.3022
③	.468	3.30	1.544	.0250	.2220
④	.140	1.75	.245	.429	.1037
⑤	.140	.375	.054	.0066	.7002
⑥	.246	.210	.052	.0036	1.435
Σ	1.50		3.917	.989	3.4560

$\bar{x} = \frac{\Sigma A_x}{\Sigma A} = \frac{3.917}{1.5} = 2.61\ in$

$I = \Sigma\left(I_x' + A(x-\bar{x})^2\right) = 3.65\ in^4$

LOADS: $M = 3000/2 = 59000\ in\text{-}lb$
$V = 9207/2 = 4600\ lb$

BENDING: $\sigma_b = \frac{Mc}{I} = \frac{59000(2.6)}{3.65} = 42200\ psi$

$M.S.\ (AGAINST\ YIELD) = \frac{\ }{42.2} - = \underline{C.61}$

DWG. 3120

SHEAR : AT THE NEUTRAL AXIS — $\tau = \frac{VQ}{It}$

$Q = .246(2.61-.2)(2.61-.375) + .032(2)(2.3)^2/2 = .04\ IN^3$

$\tau = \frac{4600(.04)}{3.65(2)(.02)} = 32\,800\ psi$

$M.S.\ (SHEAR) = \frac{46}{32.8} - 1 = \underline{0.40}$

SECTION D-D :

SECTION PROPERTIES : SAME AS SECT. D-3 EXCEPT THAT ELEMENT ⑤ IS .40 THICK AND ELEMENT ② IS 2x(.02+.032) THICK (.032 DOUBLES ADDED).

ELEM. #	AREA	x	Ax	I_x'	$A(x-\bar{x})^2$
①	.32	4.0	1.32	.0171	.7980
②	.182	3.90	.710	.0037	.3466
③	.468	3.30	1.544	.0250	.2848
④	.364	1.75	.637	.3716	.258
⑤	.140	.375	.054	.0066	.044
⑥	.234	.20	.047	.0031	1.2594
Σ	.708		4.304	.4271	3.54 IN^4

$\bar{x} = \frac{\Sigma Ax}{\Sigma A} = \frac{4.304}{1.706} = 2.52\ IN$

$I = \Sigma\left(I_x' - A(x-\bar{x})^2\right) = 3.98\ IN^4$

LOADS : $M = 82638/2 = 91\,300\ IN\text{-}LB$

$V = 11497/2 = 5750\ LB$

BENDING : $\sigma_b = \frac{Mc}{I} = \frac{91\,300(2.52)}{3.98} = 57,800\ psi$

$M.S.\ AGAINST\ YIELD) = \frac{\sigma_B}{57,800} - = \underline{0.5}$

DWG 16120

SHEAR: AT THE NEUTRAL AXIS — $\tau = \frac{VQ}{It}$

$$Q = .234(2.52-.20) + .4(2.52-.375) + 2(.02-.032)(2.52)^2/2$$
$$= 1.17 \text{ IN}^3$$

$$\tau = \frac{5750(1.17)}{3.98(.104)} = 16300 \text{ psi}$$

$$M.S. \text{ (SHEAR)} = \frac{26}{16.3} - 1 = \underline{1.3}$$

MPES

SIDE PANELS (CONT'D)

DWG. 16120

CHECK BENDING IN LEG GUARD:

LEG LOAD = 3000 LBS ULT.

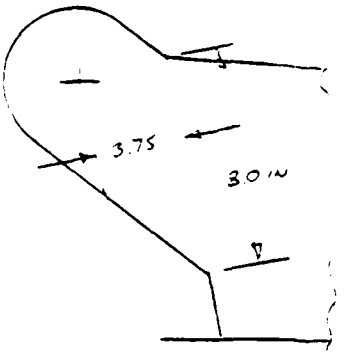
$M = .375(3000) = 11250$ IN LBS

$m = 11250/8 = 1406$ LBS/IN

$f_b = \frac{m(.3325)}{.00782}$

$f_b = \frac{1406(.3325)}{.00782}$

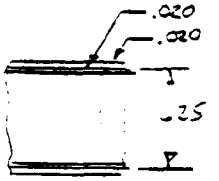
$f_b = 59782$ PSI



$t_{TOTAL} = .665$

$t_{FACE\ SHEET} = .020$

$t_{CORE} = .020$



$I = .00782$

FOR 7075-T6 $F_{cy} = 67000$ PSI

M.S. (BENDING) $= \frac{67000}{59782} - 1 =$ .12

CHECK CORE SHEAR

$f = 3000/8 = 375$ LBS/IN

$f_s = \frac{V}{d_{CORE}} = \frac{375}{(.625-.040)} = 641$ PSI

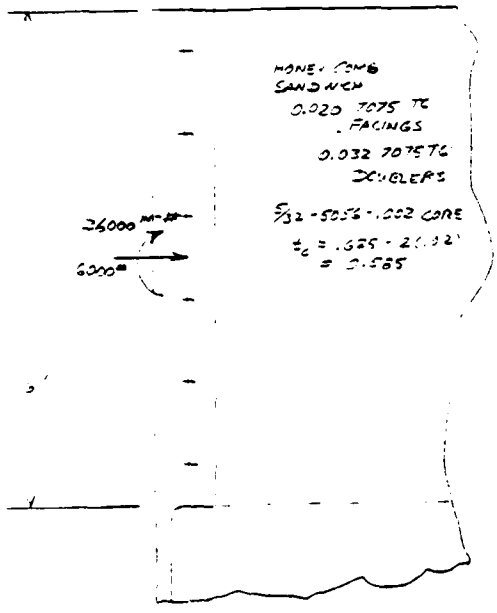
$F_{s\ CORE\ 5/32\ 5056-.002} = 610$ (MIN); 760 (TYP)

M.S (CORE SHEAR) $= \frac{610}{641} - 1 =$ −.05 (MIN)

M.S (CORE SHEAR) $= \frac{760}{641} - 1 =$ .19 (TYP)

DWG 16 CD

AFT - SIDE PANEL UPPER CONNECTION TO BACK PANEL INSERT



7075 T6 ; F_{su} (MIN) = 76 KSI
F_{by} (MIN) = 67 KSI
F_{cy} (MIN) = 68 KSI
F_{su} = 46 KSI
F_{bru} (e/D = 1.5) = 8 KSI
e/D = 2.0 = 52 KSI
F_{bry} (e/D = 1.5) = 100 KSI
e/D = 2.0 = 77 KSI

LOADS ARE FROM 12000 # ULT, FAIRING EXTRACTION LINE LOAD.

FACING STRESS :

$$I = \frac{2(.032+.032)6^2}{12} = 1.87 \text{ in}^4$$

$$\sigma_b = \frac{36000\,(3)}{1.87} = 57{,}800 \text{ psi}$$

$$\sigma_c = \frac{6000}{2(.032+.032)6} = 9620 \text{ psi}$$

TOTAL COMPRESSIVE STRESS AT THE TOP = 57800 + 9620 = 67420 psi

$$\text{M.S. (AGAINST YIELD)} = \frac{67}{67.4} - 1 = \underline{-0.01}$$

CHECK INTRACELL COMPRESSIVE BUCKLING : (FROM BRUHN, FIG. C5)

$E_c = 10.3 \times 10^6$, $S = 5/32$, $t_c = 0.052$ $\Rightarrow$ $\frac{F_{cc}}{\eta} = 650{,}000$ psi

$$\frac{F_{cy}}{F_{cc}/\eta} = \frac{67}{650} = 0.10 \Rightarrow \frac{F_c}{F_{cy}} = 1.0 \Rightarrow F_c = 67 \text{ ksi}$$

M.S. (INTRACELL BUCKLING) = $\frac{67}{67.4} - 1 = \underline{-0.6}$

CHECK COMPRESSIVE WRINKLING: (FROM BRUHN, R2.5)

$$S/t_c = \frac{5/32}{.032} = 78 \Rightarrow \frac{F_{cw}}{E_c} = .40 \text{ ksi}$$

$$\frac{F_{cy}}{(F_{cw}/n_z)} = \frac{67}{140} = 0.48 \Rightarrow \frac{F_{cw}}{F_{cy}} = 1.0 \Rightarrow F_{cw} = 67 \text{ ksi}$$

$$M.S.\ (\text{WRINKLING}) = \frac{67}{67.4} - 1 = \underline{-0.01}$$

CHECK ABILITY OF THE BOND & FASTENERS TO TRANSFER THE MOMENT INTO THE FACINGS:

UPPER FASTENER - BOLT LOAD = 6140 LB

$$\text{BOND AREA} = 2\left(.75(1.0) - \pi\left(\frac{5}{2(16)}\right)^2\right) = 1.35 \text{ in}^2$$

ASSUME 2250 psi SHEAR STRENGTH FOR THE BOND

$$P_{BOND_u} = 1.35(2250) = 3038 \text{ \#}$$

FASTENER - BEARING AREA ON FACINGS $= 2\left(\frac{5}{16}\right)(.052) = 0.0325$

$$P_{BRG_u} = 152{,}000(.0325) = 4940 \text{ \#}$$

TOTAL ALLOWABLE SHEAR TRANSFER = 3038 + 4940 = 7978

$$M.S. = \frac{7978}{6140} - 1 = \underline{0.30}$$

LOWER FASTENER - LOAD = 4140 #

THE BEARING AREA WILL BE ADEQUATE IN ITSELF TO TRANSFER THE LOAD TO THE FACINGS.

CHECK SHEAR TEAROUT OF THE UPPER FASTENER FROM THE INSERT

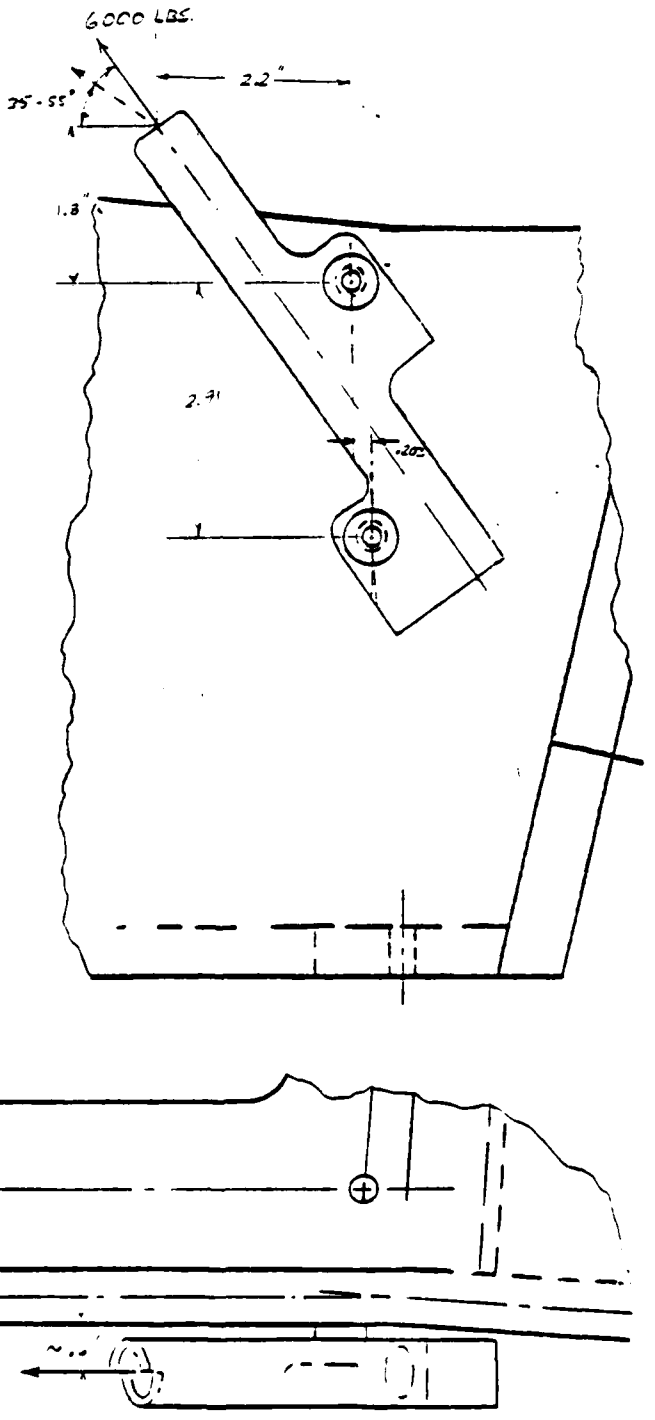
$$A_s \cong \left(0.75 - \frac{5}{6}\right)(.625 - .04) = 0.36$$

$$P_u = 0.36(46{,}000) = 2000 \text{ \#}$$

$$M.S.\ (\text{SHEAR TEAR-OUT}) = \frac{2000}{6140} - = \underline{0.95}$$

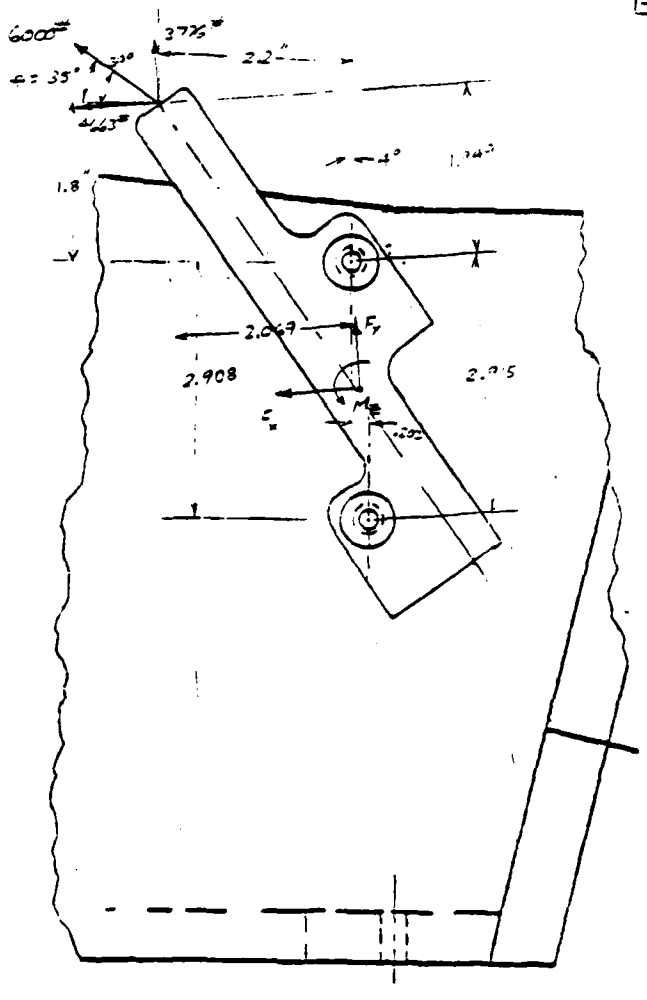
DWG 16120

SIDE PANEL — LAP BELT LOAD - 6000 LB/SIDE (ULTIMATE)



17

DWG. 16120



FOR THE LOAD ANGLE = 35° : F_x = 4663 LB

F_y = 3776 LB

$M_z = 4663\left(1.949 + \frac{2.915}{2}\right) - 3776\,(2.069)$

= 8072 IN-LB

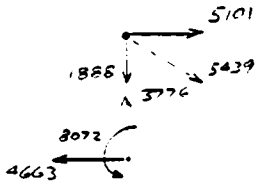
FOR THE LOAD ANGLE = 55° : F_x = 3090 LB

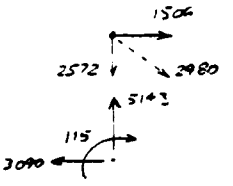
F_y = 5143 LB

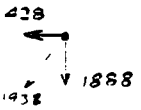
$M_z = 3090\left(1.949 - \frac{2.915}{2}\right) - 5143\,(2.069)$

= −115 IN-LB

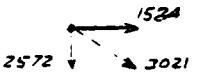
DWG. 16120



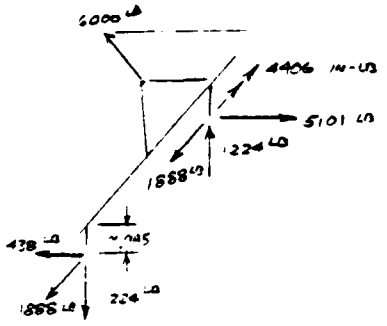


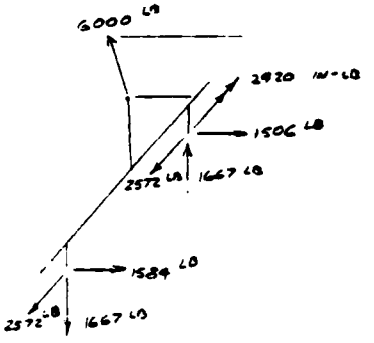


$\theta = 35°$



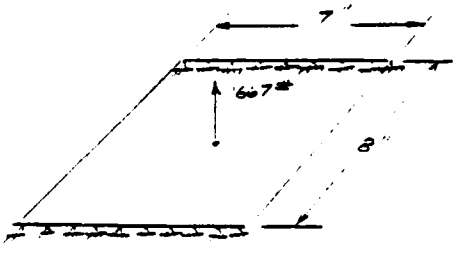
$\theta = 55°$





CHECK BENDING STRESS IN THE HONEYCOMB SANDWICH DUE TO THE NORMAL LOAD AT THE LOWER FASTENER:

TREAT AS A WIDE BEAM



EFFECTIVE WIDTH = .65(7) = 4.55

(FROM ROARK, 5TH ED. pg. 16
(Ref. 6)

DWG. 16120

$M \cong \frac{1667(8)}{4} = 3334$ IN-LB

$\sigma = \frac{M}{b(t)(h-t)} = \frac{3334}{4.55(.052)(.689-.052)} = 22121$ psi

$M.S. = \frac{68}{22.121} - 1 = \underline{2.07}$

CHECK CORE SHEAR: $\tau_c = \frac{2(1667/2)}{4.55(.689+.585)} = 288$ psi

$M.S. = \frac{360}{288} - 1 = \underline{0.25}$

CHECK ABILITY OF LOWER FASTENER TO CARRY THE IN-PLANE LOAD:

ASSUME ALL OF THE LOAD IS TRANSFERRED INTO THE FACE SHEETS.

$A_{br} = 0.052(.81+.62) = 0.0744$ IN^2

ALLOWABLE BRG. LOAD = 68000 (COMP. YIELD STRESS) $(0.0744) = 5059$ LB

$A_{ADHESIVE} \cong 2$ IN^2

ALLOWABLE SHEAR ON THE ADHESIVE = $2(2250) = 4500$ LB

TOTAL ALLOWABLE IN-PLANE LOAD = 9559 LB

$M.S. = \frac{9559}{3021} - 1 = \underline{2.2}$

BY INSPECTION, NO OTHER AREAS WILL BE CRITICAL

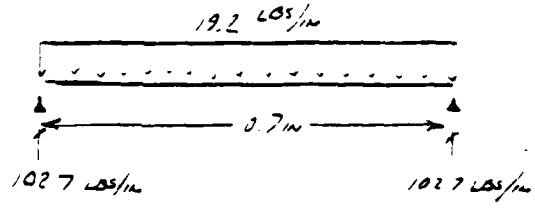
WIPES

FRONT PANEL DWG 16160

LOAD 1544 LBS/FT² LIMIT = 2766 LBS/FT² ULT = 19.2 PSI

AREA = 15.33 X 10.7 = 196 IN.

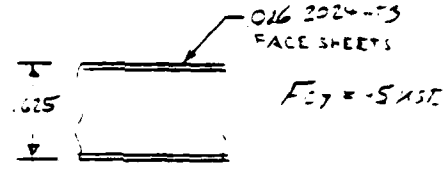
CONSIDER BENDING ACROSS SHORT SPAN



$$M_{MAX} = 102.7\left(\frac{10.7}{2}\right) - \frac{1}{2}(19.2)\left(\frac{10.7}{2}\right)^2 = 275 \text{ IN LBS}$$

$$f_b = \frac{275(.625/2)}{.0030} = 28646 \text{ PSI}$$

M.S. (BENDING) $= \frac{45}{28.6} - 1 =$ .57



$$I = \frac{.625^3}{12} - \frac{(.625-.032)^3}{2} = .0030 \text{ IN}^4$$

CHECK CORE SHEAR

$$v_{MAX} = 1027/(.625-.032) = 173 \text{ PSI}$$

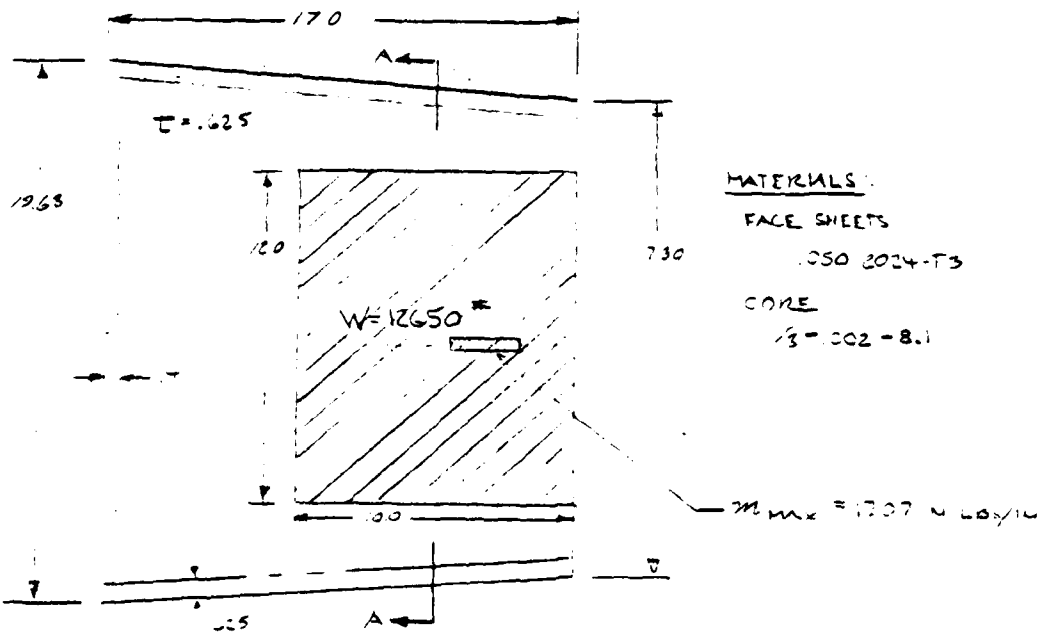
FOR 3/16-5052-.001 CORE $F_{s_{L}} = 200$ PSI

M.S. (CORE SHEAR) $= \frac{200}{173} - 1 =$ .15

MDES

SEAT PANEL

DWG. 16130



BENDING CHECK

USING A 3-D COMPUTER ANALYSIS, THE MAXIMUM BENDING MOMENT IS

m_{MAX} = 707 IN LBS/IN

$\sigma_o = Mc/I$ = 1707 (.625/2) / [illegible]

$\sigma_{o_{MAX}}$ = 6437 PSI

USING 2075-T6 FACE SHEETS ; E_{FS} = [illegible] PSI

M.S. (BENDING) = [illegible] = .03

MPEL

SPLT PANEL CONF'N | CNG 1350

CHECK CORE

MATERIAL: /R-COL- 3.1 EOSG AL.

CHECK CORE CRUSHING

MAX EDGE SHEAR FROM 3-D MODEL

$\sigma_c = \frac{567}{1(.6)} = 945$ psi

(1) BRG AREA

(REF. HEXCEL "MPEL ... PROPERTIES OF HEXCEL ... COMPRESSIVE STRENGTH = 1200 psi (MIN) HONEYCOMB MATERIALS", TSB120 REVISED 1971 : REF 4)

M.S CORE CRUSHING = $\frac{1200}{945} - 1$ 0.27

CHECK CORE SHEAR

FROM 3-D ANALYSIS V_{MAX} = 567 LBS/IN

$\tau_{3\,MAX} = \frac{2\,567}{.523 + 522} = \frac{2\,567}{1045} = 950$ psi

USE CORE SHEAR STRENGTH OF 740 PSI MIN.
(REF HEXCEL TSB 120 REVISED 1971)

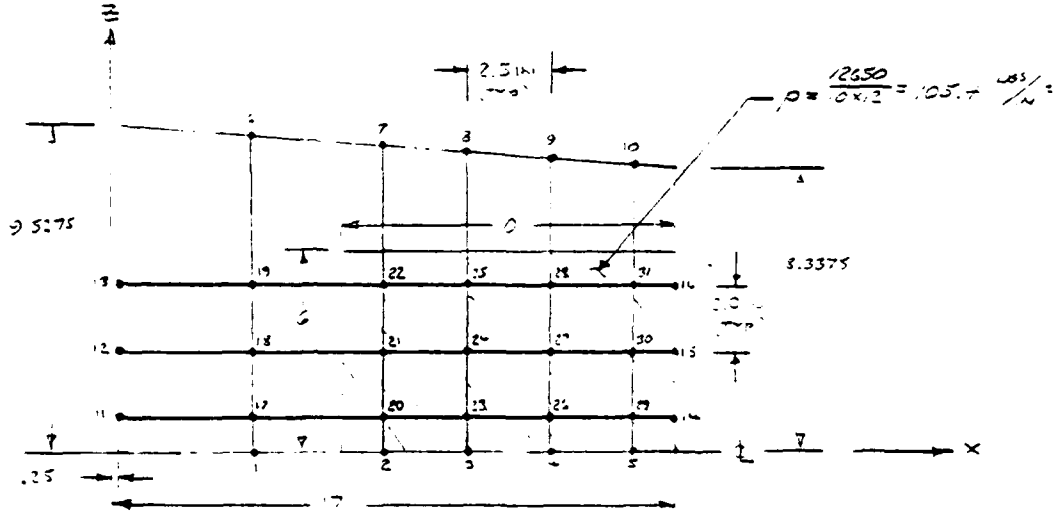
M.S (CORE SHEAR) = $\frac{740}{950} - 1 =$ -.22

ACCEPTABLE: TYPICAL CORE SHEAR STRENGTHS ARE 900 PSI [illegible] M.S = +.09 NO TEST EVIDENCE PLANNED AT THIS TIME

MPES

SEAT PANEL CONT'D DWG. 6130

SEAT PAN AND SUPPORT FRAME LOADS ARE OBTAINED FROM THE FOLLOWING 3-D COMPUTER MODEL:



NODES 20 THRU 31 ARE LOADED WITH 527 LBS. EACH. NODES THRU 5 ARE RESTRAINED AGAINST ROTATION ONLY. NODES 6 THRU 16 ARE RESTRAINED AGAINST Y DISPLACEMENT ONLY.

MPES

SEAT PANEL (CONT'D)

DWG [illegible]

INPUT DATA

JOINT	COORDINATES		DEGREES OF FREEDOM	RESTRAINTS			LOAD	P_Y
	X	Z		Y	θ_X	θ_Z		
1	4.25	0	1	0	1	1	0	
2	8.25	0	〃	0	1	1	〃	
3	10.75	0		0	1	1		
4	13.25	0		0	1	1		
5	15.75	0		0	1	1		
6	4.25	9.23		1	0	1	NOT LOADED	
7	8.25	8.95		1	0	1		
8	10.75	8.78		1	0	1		
9	13.25	8.60		1	0	1		
10	15.75	8.43		1	0	1		
11	.25	1		1	1	0		
12	.25	3		1	1	0		
13	.25	5		1	1	0		
14	17	1		1	1	0		
15	17	3	▼	1	1	0		
16	17	5	1	1	1	0		
17	4.25	1	3	0	0	0		
18	4.25	3	〃	〃	〃	〃	▼	
19	4.25	5					0	
20	8.25	1					1	527
21	8.25	3					1	〃
22	8.25	5					1	
23	10.75	1		0 = UNRESTRAINED			1	
24	10.75	3					1	
25	10.75	5					1	
26	13.25	1					1	
27	13.25	3					1	
28	13.25	5					1	
29	15.75						1	
30	15.75	3	▼	▼	▼	▼	1	▼
31	15.75	5	3	0	0	0	1	527

SEAT PANEL (CONT'D)

INPUT DATA (CONT'D)

ELEMENT	CONNECTIVITY JT. 1	CONNECTIVITY JT. 2	AREA	I
1	11	17	.2	.01658
2	17	20	〃	〃
3	20	23		
4	23	26		
5	26	29		
6	29	14		
7	12	18		
8	18	21		
9	21	24		
10	24	27		
11	27	30	↓	↓
12	30	15	.2	.01653
13	13	19	.31851	.02640
14	19	22	.30453	.02525
15	22	25	.29316	.02431
16	25	28	.28442	.02358
17	28	3	.27553	.02286
18	31	6	.26913	.02231
19		—	.4	.03316

ELEMENT	CONNECTIVITY JT. 1	CONNECTIVITY JT. 2	AREA	I
20	17	18	.4	.03316
21	18	19	.4	.03316
22	9	6	.4	.03316
23	2	20	.3125	.02594
24	20	21	〃	〃
25	21	22	↓	↓
26	22	7	.3125	.02594
27	3	23	.25	.02073
28	23	24	〃	〃
29	24	25		
30	25	8		
31	—	26		
32	26	27		
33	27	28		
34	28	9		
35	5	29		
36	29	30		
37	30	31	↓	↓
38	31	10	.25	.02073

MPES

DWG 1417 C

SEAT PANEL (CONT'D)

OUTPUT DATA

DISPLACEMENT

JOINT	δ_T
1	.307
2	.500
3	.495
4	.368
5	.137
6	0
7	↓
8	
9	
10	
11	
12	
13	
14	
15	↓
16	0
17	.302
18	.266
19	.200
20	.493
21	.432
22	.319
23	.487
24	.426
25	.311
26	.360
27	.316
28	.223
29	.135
30	.113
31	.085

MEMBER LOADS

EL.	JOINT 1		JOINT 2	
	V	M	V	M
1	-263	0	263	-1052
2	-474	1052	474	-2947
3	-187	2947	187	-3414
4	178	3414	-178	-2968
5	620	2968	-620	-1417
6	1134	1417	-1134	0
7	-242	0	242	-967
8	-407	967	407	-2596
9	-147	2596	147	-2963
10	163	2964	-163	-2557
11	523	2557	-523	-1250
12	1000	250	-1000	0
13	-324	0	324	-1295
14	-403	1295	403	-2906
15	-67	2906	67	-3075
16	252	3075	-252	-2445
17	530	2445	-530	-1120
18	896	1120	-896	0
19	0	3099	0	-3099
20	210	3099	-210	-2678
21	376	2678	-376	-1925
22	455	1925	-455	0
23	0	4251	0	-4251
24	240	4251	-240	-3771
25	506	3771	-506	-2758
26	698	2758	-698	0
27	0	3300	0	-3300
28	162	3300	-162	-2977
29	379	2977	-379	-2219
30	537	2219	-537	0
31	0	2473	0	-2473

MEMBER LOADS (CONT'D)

EL.	JOINT 1		JOINT 2	
	V	M	V	M
32	85	2478	-85	-2307
33	252	2307	-252	-1803
34	501	1803	-501	0
35	0	920	0	-920
36	13	920	-13	-893
37	63	893	-63	-767
38	224	767	-224	0

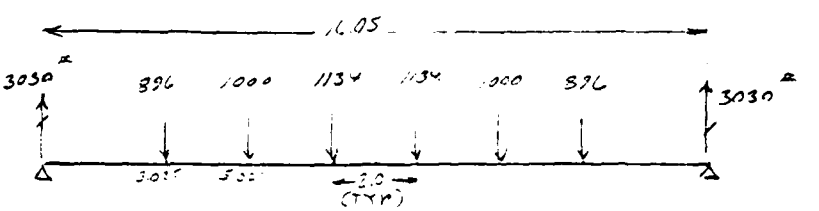
REACTIONS

JOINT	R_Y
6	455
7	598
8	537
9	501
10	224
11	263
12	242
13	324
14	134
15	1000
16	896

$\Sigma = 6324 \times 2 = 12648$

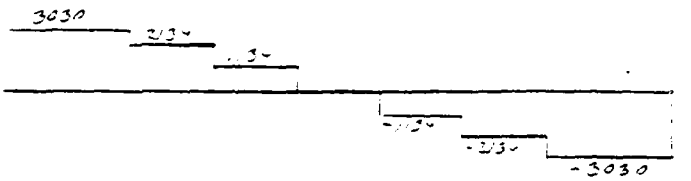
MRES. DMS 5.5.5

SUPPORT CHANNEL

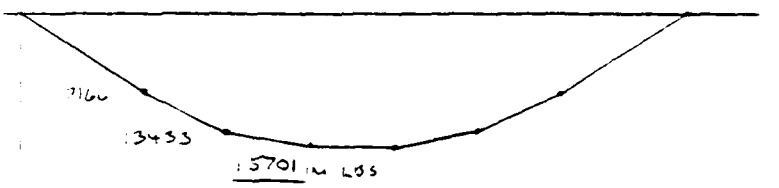


LOADS FROM 3-D COMPUTER ANALYSIS

V



M

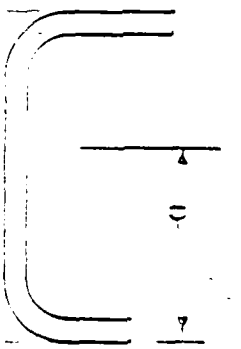


$f_b = Mc/I$

$f_b = \frac{15701\,(1.067)}{.246} = 68101$ PSI

F_{TU} 7075-T6 = 78000 PSI

M.S (BENDING) $= \frac{78000}{68101} - 1 =$ .15



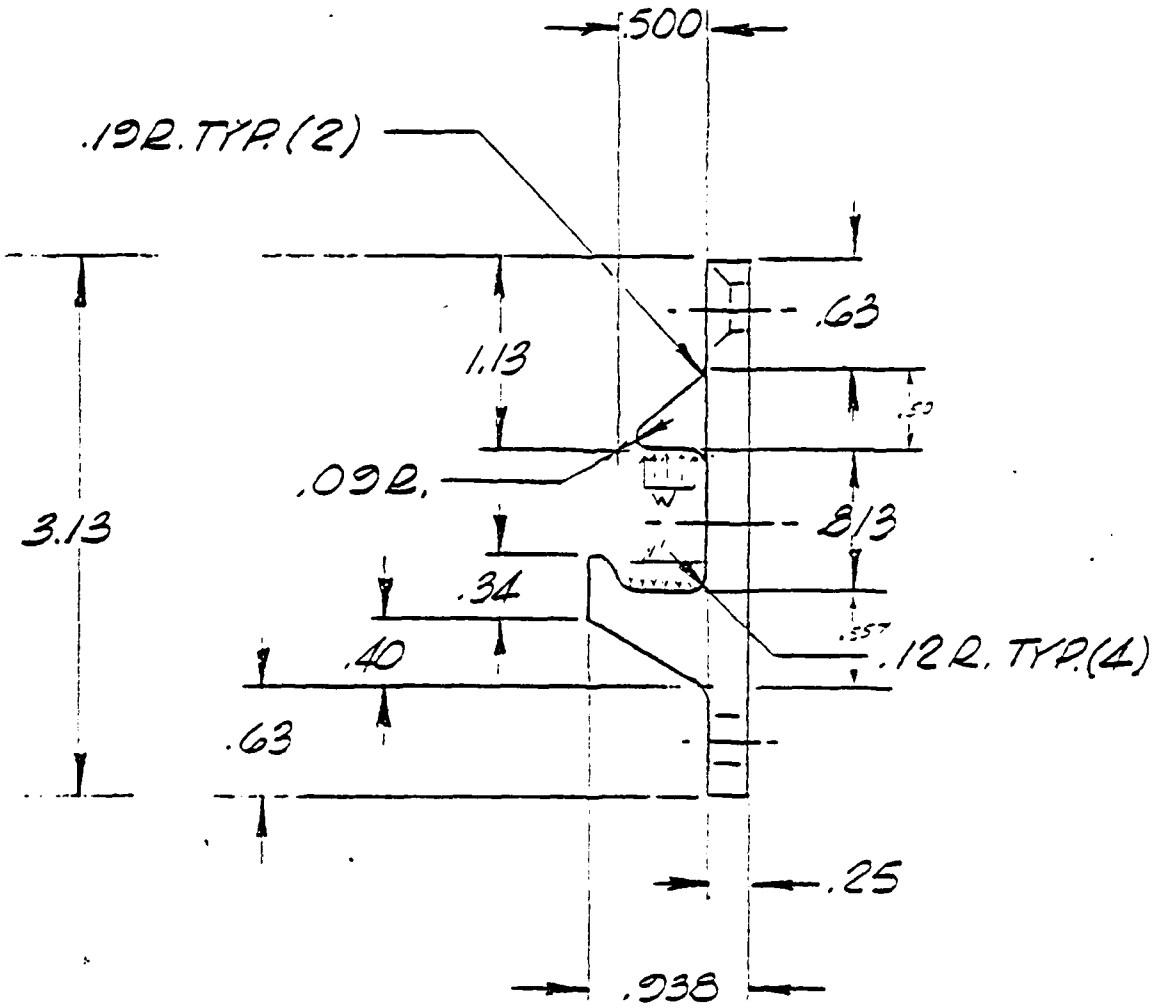
A = .4375 in²
$\bar{Y}$ = .067 in
I_x = .246

MPES

28

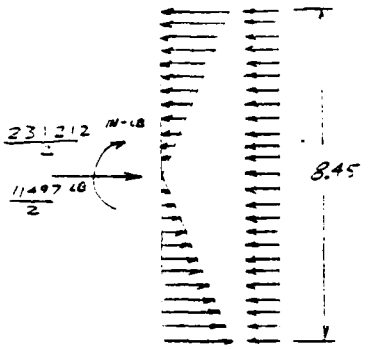
DWG. [illegible]

GUIDE RAIL



DWG. 16200

ASSUME THE LOADS ARE REACTED @ AN 8.45 INCH LENGTH OF THE ROD.



$$N' = \frac{11497}{2(8.45)} + \frac{231212\,(6)}{2\,(8.45)^2} = 1034.5 \text{ LB/IN}$$

$$N = -\frac{11497}{2(8.45)} + \frac{231212\,(6)}{2\,(8.45)^2} = 903.4 \text{ LB/IN}$$

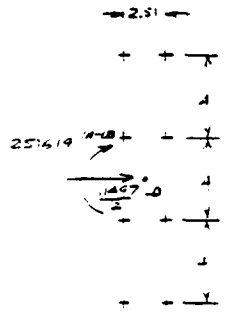
CHECK SHEAR STRESS: $f_s' = \frac{10345}{.557} = 8562$ psi

$f_s = \frac{9034}{1.5} = 8068$ psi

$F_{su} = 42000$ psi

$$M.S.\ (SHEAR) = \frac{42}{18.7} - 1 = \underline{\underline{1.2}}$$

ASSUME THAT THESE LOADS ARE TRANSFERRED INTO THE ATTACHMENT BY THE TOP 8 FASTENERS.



$$J = \Sigma A(x^2+y^2) = 4A_b\left[(6)^2 + \left(\frac{2.51}{2}\right)^2 + (2)^2 + \left(\frac{2.51}{2}\right)^2\right] = 172.6\,A_b$$

$$A = 8A_b$$

$$f_{MAX} = \frac{251619\sqrt{(6)^2+\left(\frac{2.51}{2}\right)^2}}{(2)172.6A_b}A_b + \frac{11497}{(2)8A_b} = 5187 \text{ LB}$$

¼" Ø 160 KSI MIN. UTS FASTENERS, $F_{su} = 4660$ LBS

$F_{BRU} > 4660$ LBS

$$M.S.\ (FASTENER\ CHECK) = \frac{4660}{5187} - 1 = \underline{\underline{-0.0}}$$

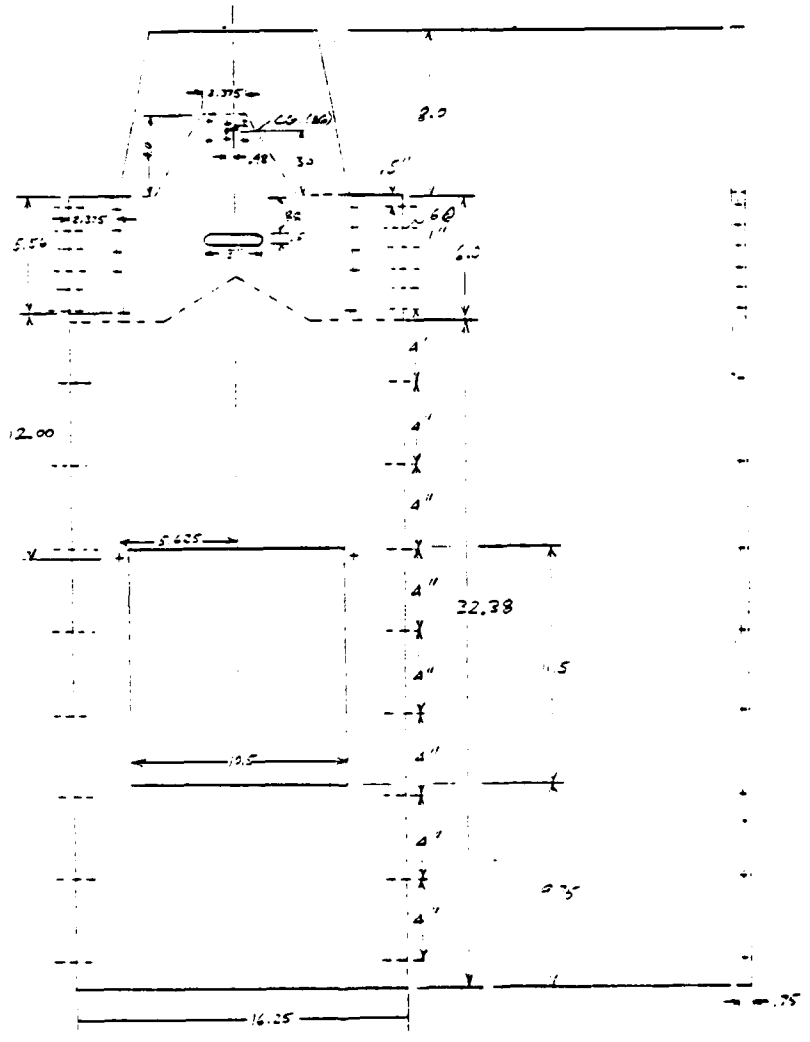
THIS MARGIN OF SAFETY IS TO BE ACCEPTABLE BECAUSE OF THE TRANSIENT NATURE OF THE TWIST IN THE LINKS, AND THE FACT THAT THE OTHER BOLT WILL REACT SOME OF THE LOAD.

DWG No. 3

MPES BACK PANEL

GEOMETRY

℄ SYM (EXCEPT AS SHOWN)

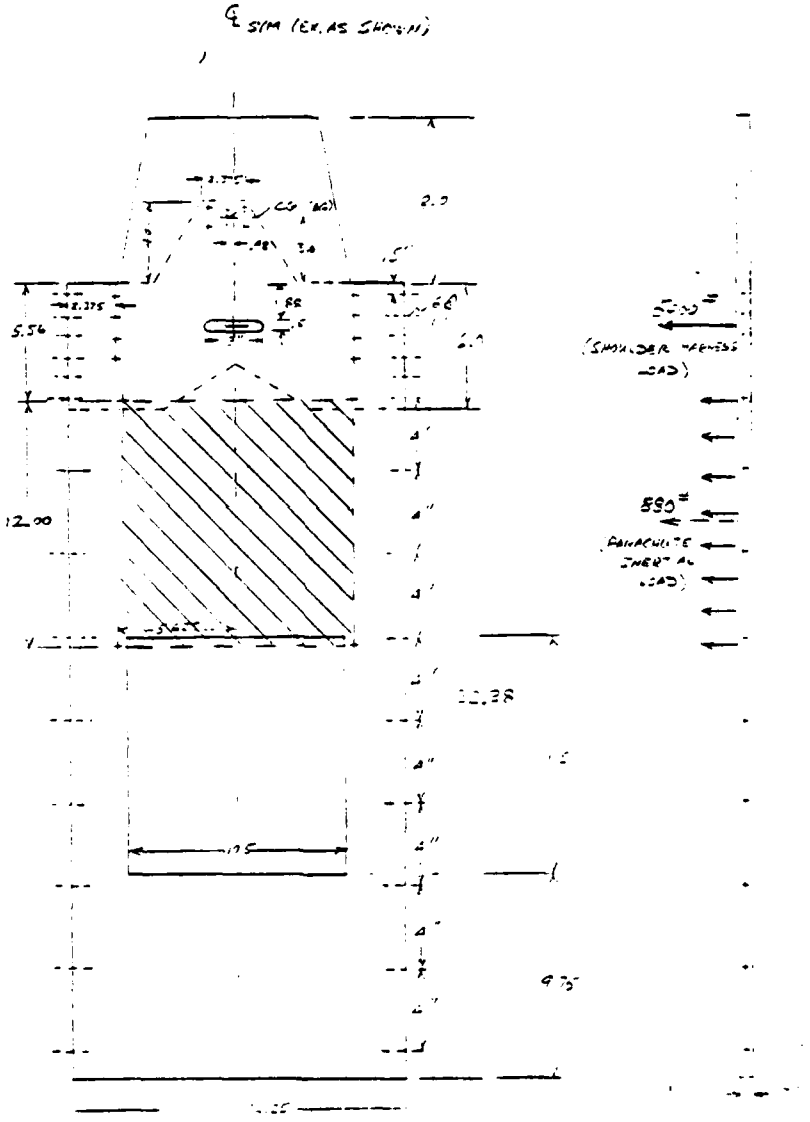


② LOADS

□ CRASH LOADS

⬡ 40 G FORWARD CRASH LOADS

(NOTE: THESE ARE ULTIMATE LOADS)



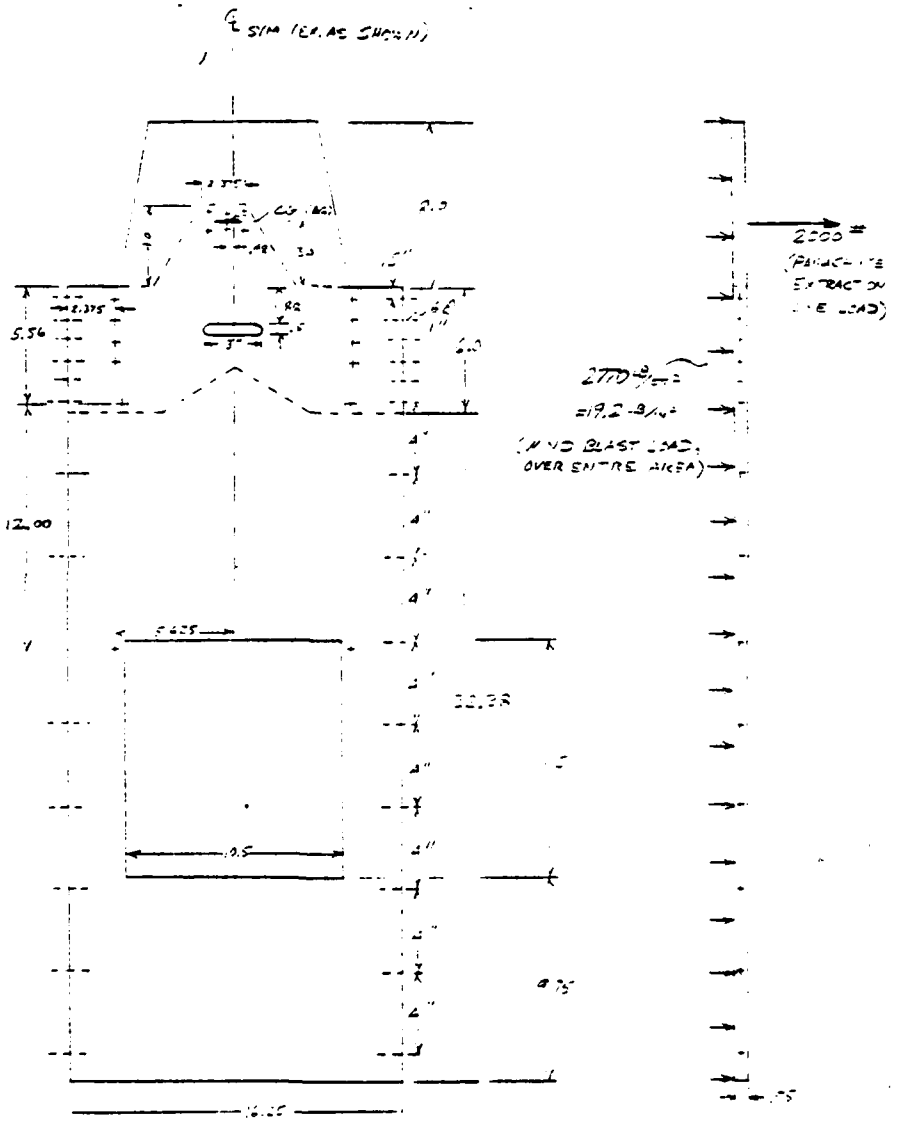
32

DWG 16110

(E) AND B DOWNWARD CRASH LOADS - THIS CONDITION DOES NOT CAUSE ANY SIGNIFICANT LOAD IN THE BACK PANEL.

(F) EJECTION LOADS (NOTE: THESE ARE ULTIMATE LOADS)

W/ NO BLAST AND PARACHUTE LOADS - WILL NOT NOT SATISFY EJECTION CRITERIA THE SEAT WILL HAVE SLOWED DOWN PRIOR TO ORDINATE OF THE PARACHUTE.



DWG 6 0

③ MATERIALS

FRAME - 7075 T6 (BAR) - F_{tu} = 77 ksi, F_{ty} = 66 ksi, F_{cy} = 64 ksi, F_{su} = 45 ksi, F_{bru} (e/D=1.5) = 100 ksi, F_{bru} (e/D=2.0) = 123 ksi

UPPER INSERT - 7075 T6 (PLATE) - F_{tu} = 77 ksi, F_{ty} = 70 ksi, F_{cy} = 68 ksi, F_{su} = 44 ksi, F_{bru} (e/D=1.5) = 118 ksi, F_{bru} (e/D=2.0) = 43 ksi

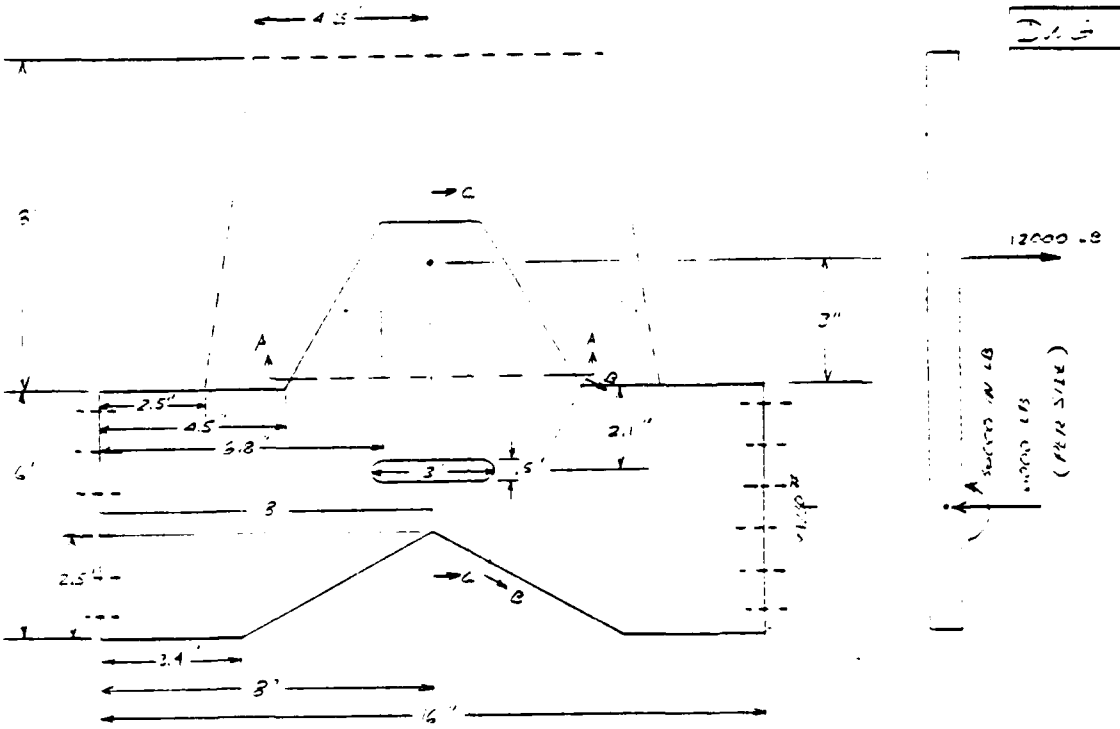
PANEL - HONEYCOMB SANDWICH - FACINGS 0.020 7075 T3

F_{tu} (L) = 76 ksi, (LT) = 75 ksi
F_{ty} (L) = 62 ksi, (LT) = 57 ksi
F_{cy} (L) = 68 ksi; (LT) = 71 ksi
F_{su} = 41.5 ksi
F_{bru} (e/D=1.5) = 118 ksi, (e/D=2.0 = 52 ksi
F_{brY} (e/D=1.5) = 100 ksi, (e/D=2.0 = 44.7 ksi

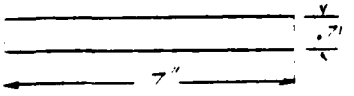
- CORE 5/32 - 5052 - .001
DENSITY = 3.8 pcf
COMPRESSIVE STRENGTH = 375 psi (MIN)
" MODULUS = 40 ksi
CRUSH STRENGTH = 235 psi
PLATE SHEAR - L DIRECTION
STRENGTH = 270 psi (MIN)
MODULUS = 57 ksi
- W DIRECTION
STRENGTH = 155 psi (MIN)
MODULUS = 24 ksi

④ STRESS ANALYSIS - BY EXAMINATION, THE STATION LOAD CONDITION WILL BE CRITICAL.

[1] INSERT PLATE - THE INSERT PLATE IS SUBJECTED TO A 12000 # LOAD ⊥ TO THE PLATE. (WORST CONDITION)



SECTION A-A :



$A = 7(.71) = 4.97 \ in^2$

$I = \frac{7(.71)^3}{12} = 0.209 \ in^4$

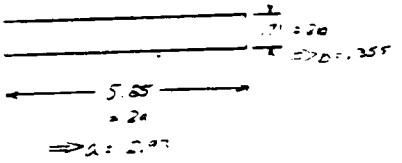
$M = 12000(3) = 36000 \ in\text{-}lb$

$\sigma_b = \frac{36000\left(\frac{.71}{2}\right)}{0.209} = 61200 \ psi$

PLASTIC BDG. ALLOWABLE = 118 ksi

$M.S.\ (BENDING) = \frac{118}{61.2} - 1 = \underline{0.93}$

SECTION B-B:



SECTION DEFLECTION:

$A = 5.85(.71) = 4.15\ in^2$

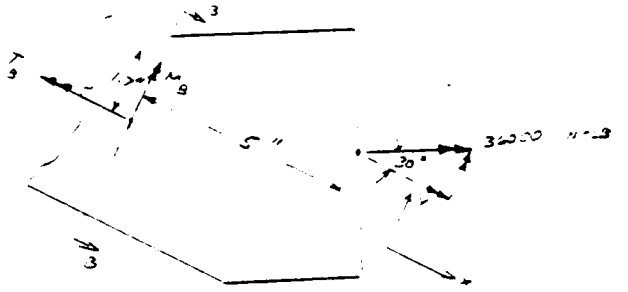
$I = \frac{2(.85)(.71)^3}{2} = 0.174\ in^2$

TORSIONAL SHEAR CONSTANT (FOR $\tau = \frac{T}{C}$)

$C = \frac{B_1 t_0^2}{(3a + 1.8b)} = \frac{5.85(.71)^2(.355)}{3(2.93) + 1.8(.355)}$

$= 0.918\ in^3$

LOADS:



$\Sigma M_x = 0 = -T_B + 36000 \cos 30° + 6000(.7) \Rightarrow T_B = 4400$ in-lb

$\Sigma M_y = 0 = M_B - 36000 \sin 30° - 6000(5) \Rightarrow M_B = 2000$ in-lb

$\sigma_b = \frac{2000(\frac{.71}{2})}{.174} = 24,500$ psi $\Rightarrow R_B = \frac{24.5}{15} = 0.21$

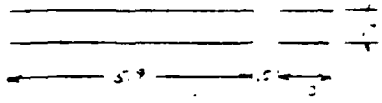
$\tau = \frac{4400}{0.918} = 45,000$ psi $\Rightarrow R_S = \frac{45.1}{44} = 1.03$

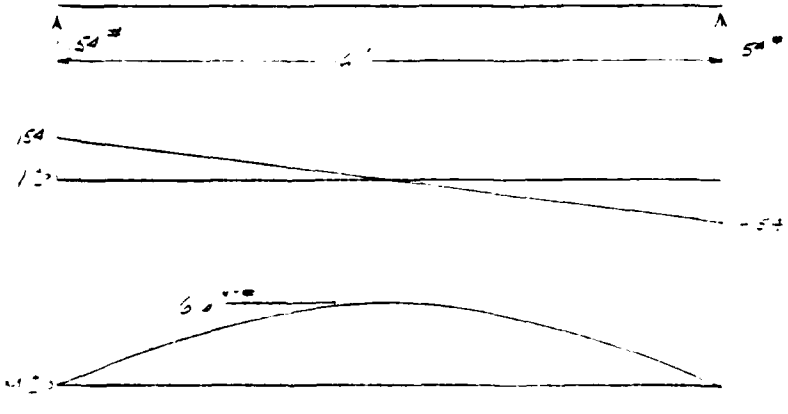
M.S. (BENDING + TORSION) $= \frac{1}{R_B^2 + R_S^2} - 1 = \frac{1}{.21^2 + 1.03^2} - 1 = -0.06$

IF $\tau = .75$ (ASSUME SHEAR WEB EFFECTIVE), $\sigma_b = 24,500$ psi $\Rightarrow R_B = 0.21$

$\tau = \frac{4400}{.152} = 44,500$ psi $\Rightarrow R_S = 0.92$

M.S. = 0.06





CHECK FACING COMPRESSIVE STRESS:

$$\sigma = \frac{M}{A_f d} = \frac{\quad}{\quad} = \quad \text{psi}$$

M.S. AGAINST COMPRESSIVE YIELD $= \frac{\quad}{\quad} - 1 =$ 0.6

CHECK CORE SHEAR: $\tau = \frac{V}{c(d+t_f)} = \frac{\quad}{\quad} = \quad$ psi

M.S. (CORE SHEAR) $= \frac{\quad}{\quad} - 1 =$ -0.27

THE VALUE USED THE MIN VALUE FOR THE W DIRECTION, SINCE THE RIGID DIRECTION IS SPECIFIED USE THE MIN. VALUE FOR THE L DIRECTION.

M.S. (CORE SHEAR) $= \frac{\quad}{\quad} - 1 =$ 0.20

CHECK INTRACELL COMPRESSIVE BUCKLING: (FROM GRUMM. SEC 5)

$\frac{t_f}{t_c} = \quad \frac{E_f}{E_c} = \quad \nu_f = 0.32 \Rightarrow \frac{F_{cc}}{E_f} =$ 354,000 psi

$\frac{F_{cc}}{F_{cc_1}} = \frac{\quad}{\quad} = \quad \Rightarrow F_{cc}/F_{cc_1} = \quad \Rightarrow F_{cc} =$

M.S. $= \frac{F_{cc}}{\quad} - 1 = \frac{\quad}{\quad} - 1 =$ 0.0

CHECK INTERCELL COMPRESSIVE BUCKLING: (FROM GRUMM. SEC 5)

$\frac{t_f}{t_c} = \quad \frac{E_f}{E_c} = \quad \nu_f = 0.32 \Rightarrow \frac{F_{cc}}{E_f} = 56 \Rightarrow F_{cc} =$ 80 ksi

$\frac{F_{cc}}{F_{cc_1}} = \frac{\quad}{\quad} = \quad \Rightarrow F_{cc}/F_{cc_1} = \quad \Rightarrow F_{cc} =$

M.S. $= \frac{\quad}{\quad} - 1 =$ 0.0

DWG 5 0

CHECK DOME COMPRESSIVE STRESS (FROM HEXCEL DESIGN HOLE THEORY REF 3

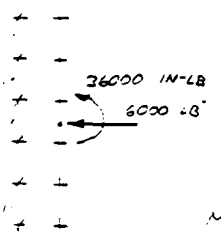
FLEXURE LOADED STEEL:

$$F_c = \frac{2F_x^2}{E_f(t/c-1)} = \frac{2(42200)^2}{23\times10^6(.75/.92-1)} = 9.5\ ksi$$

CORE CRUSHING WILL NOT BE A PROBLEM

DWG 161 C

UPPER INSERT FASTENERS



BOLT GROUP PROPERTIES:

$J = \Sigma A r^2 = 2A_o[2.5^2 + 1.5^2 + 5^2] = 75A_o$

$$\text{MAX. SHEAR} = \frac{Tc}{J}A_o = \frac{V}{n} = \frac{36000(2.5)}{17.5A_o}A_o = \frac{6000}{5} = 6140 \text{ LB.}$$

$\frac{5}{16}''\phi$, 60 KSI MIN. UTS FASTENERS ARE USED, f_{allow} = 7200 LB

$$M.S. = \frac{7200}{6140} - 1 = \underline{0.19}$$

LOWER FRAME TO SIDE PANEL FASTENERS

MAX SHEAR = 4 IN x 54 #/IN = 66 LB

THESE ARE $\frac{3}{16}''\phi$ 60 KSI MIN UTS FASTENERS, f_{allow} = 2333 #

$$M.S. = \frac{2333}{66} - 1 = \underline{3.3}$$

IV. References

(1) Naval Air Developement Center, Request for Proposal No. N62269-79-R-0712, July 23, 1979.

(2) Department of Defense, Military Standardization Handbook-Metallic Materials and Elements for Aerospace Vehicle Structures, MIL-HDBK-5B, September 1, 1971.

(3) Hexcel Corporation, Design Handbook for Honeycomb Sandwich Structures, TSB 123, March, 1970.

(4) Hexcel Corporation, Mechanical Properties of Hexcel Honeycomb Materials, TSB 120, 1971.

(5) E. F. Bruhn, Analysis and Design of Flight Vehicle Structures, Tri-State Offset, 1973.

(6) Raymond J. Roark and Warren C. Young, Formulas for Stress and Strain, McGraw-Hill, 5th Edition, 1975.

A P P E N D I X C

MPES
SEAT STRUCTURE
FABRICATION PROCEDURE

a LATTY INDUSTRIES Company

PRODUCTION ROUTE CARD

JOB ORDER NO. _____ PRODUCTION ORDER NO. _____ SHEET 1 OF 9

SSY ART NO	X16100	DWG REV NR	LOT NO
SCRIPTION	MPES - Seat Bucket Assy.		QTY PER W O
			QTY ACCEPT
EXT SSY RT NO		QTY PER NEXT ASSY	QTY REJECT
SSY RIAL O(S)			
FFECTIVITY			
OTES			

ATE W O ISSUED		REQ COMP DATE	
SSUED BY		RECEIVED BY	
DATE W O RECD		DATE W O COMP	
CCEPTED (QC)		ACCEPTANCE DATE	
OTAL TIME		UNIT TIME	

PREPARED J. Enloe DATE 5/13/80

APPROVED SYS. _____ DATE _____

Q.A. [signature] DATE 5/17/80

REVISIONS

PRC REV	DWG REV	REASON FOR CHANGE	OPERATIONS AFFECTED	DATE	PREP BY	APPR BY

ASSEMBLY/PARTS LIST PARTS ISSUED BY _____

ELM O	QTY ASSY	QTY W O	QTY ISS'D	DATE / BY	PART NUMBER	REV	PART NAME/MATERIAL	MATERIAL SIZE	MATERIAL SPEC	RAW MATL /CERT NO
							** SEE SHEET TWO**			

C-1

NADC-80208-60

STE _ AERO ENGINEERING CORPORATION
a TALLEY INDUSTRIES Company

ASSEMBLY PART NO X16100

SHEET 2 OF 9

PRODUCTION ROUTE CARD

JOB ORDER NO. _____ PRODUCTION ORDER NO. _____

ASSEMBLY/PARTS LIST

ITEM NO	QTY ASSY	QTY W O	QTY ISS'D	DATE / BY	PART NUMBER	REV	DESCRIPTION	REMARKS
1	2				16100-11		Fastener Tape, Hook W/adhesive	MIL-F-21840
							Back metal Nylon, Black 1 x 3	Type I, Cl. I
2	1				16100-13		Fastener Tape, Hook W/adhesive	MIL-F-21840
							Back metal Nylon, Black	Type I Cl. I
							1 x 4 1/2	
3	2				16100-15		Shim, 7075-T6 Al. Alloy	QQ-A-250/12
							.093 x 2.75 x 3.75	
4	1				16110-1		Back Panel Assy.	
5	1				16120-1		Side Panel Assy. L.H.	
6	1				16120-2		Side Panel Assy, R.H.	
7	1				16130-1		Seat Panel Assy.	
8	1				16140-11		Motor Supt. Plate	
9	1				16160-1		Front Panel Assy.	
10	1				16171-1		Seat Cushion Assy.	
11	1				16180-11		Closure	
12	1				16181-11		Supt. Channel	
13	1				16190-1		Brace Assy.	
14	1				G.F.E.		Fitting L.H.	
15	1				G.F.E.		Fitting, R.H.	
16	55				AN960-C10L		Washer, Flat	
17	34				AN960-C416L		Washer, Flat	
18	12				AN960-C516L		Washer, Flat	
19	4				FFN6010-10-C		Nut Plate, Floating	
20	1				FFN6010-12-C		Nut Plate, Floating	
21	25				NAS6203-4		Bolt, Hex HD	
22	30				NAS6203-11		Bolt, Hex HD.	
23	2				NAS6204-11		Bolt, Hex HD.	
24	16				NAS6204-17		Bolt, Hex HD.	
25	12				NAS6205-11		Bolt, Hex HD.	
26	17				MS20470-AD5		Rivet, Unv. HD.	
27	16				MS21042-4		Nut, Self, Locking	
28	14				MS24694-59		Screw, Mach, Fl. HD.	
29	4				MS24694-62		Screw, Mach, Fl. HD.	

STERLING ALLOY ENGINEERING CORPORATION
a TALLY INDUSTRIES Company

PRODUCTION ROUTE CARD

ASSEMBLY PART NO X16100

ASSEMBLY NAME MPES - Seat Bucket Assy.

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 3 OF

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER TOTH	MANHOURS INSP HR	MANHOURS INSP TOTH	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF ITEM
PA	10	Assemble L.H. Side Panel (16120-1), R.H. Side Panel (16120-2), Seat Panel Assy. (16130-1), and Front Panel Assy. (16160-1) together with #6-32 Screws (thru temporary tapped holes). Align front panel flush with top edge of both side panels and forward edge of seat pan and drill thru existing pilot holes with a #7 drill, (5) holes thru each side panel and (4) holes thru seat panel. Deburr holes as required. CAUTION: HOLE DEPTH THRU SEAT PANEL AND FRONT PANEL CAN'T EXCEED .55 INCHES							
PA	20	Disassemble parts and tap (14) holes in Front Panel with a #10x32 Helicoil tap.							
PA	30	Install (14) Helicoils Inserts (MS21209F1-20) wet with primer in front panel.							
QC	35	First piece inspection and subsequent spot check.							
PA	40	Assemble L.H. Side Panel, R.H. Side Panel, Front Panel, Motor Support Plate, and the Back Panel Assy. (16110-1) together by installing (temporarily), bolts into front panel and #6-32 screws thru other panels Align Back Panel and locate position of (6) holes in each side panel with (6) 5/16 inch holes in top of each side of back panel. Also, locate position of (8) .200 - .205 holes.							
PA	50	Drill thru (6) holes in each side panel that were in operation 40 with size "P" Drill (.322 - .329). Drill thru (8) holes located in each side panel that were located in operation 40 with a #7 Drill (.200 - .205). Deburr holes as required.							

111A00907-258 SHEET

C-3

NADC-80208-60

STEWART AERO ENGINEERING CORPORATION
a TALLY INDUSTRIES Company

PRODUCTION ROUTE CARD

ASSEMBLY PART NO: X1o100
ASSEMBLY NAME: MPES - Seat Bucket Assy.

JOB ORDER NO.

PRODUCTION ORDER NO.

SHEET 4 OF 9

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER TOOL	MANHOURS INSP HR	MANHOURS INSP TOOL	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF
PA	60	Temporarily re-assemble parts called out in operation 40 and drill thru (8) holes (.200 - .205) in each side panel into each side of back panel (.61 deep) with a #7 drill.							
PA	70	Disassemble and tap (16) holes in side of back panel with a 10x32 Helicoil tap.							
PA	80	Install (16) helicoil Inserts (MS21209F1-20) wet with primer in back panel.							
QC	85	First piece inspection and subsequent spot check operations 40 thru 80.							
PA	90	Drill thru (18) Pilot holes in Seat Panel using a #7 Drill (.200 - .205) and countersink top side 100^{0} x .385 Dia.							
PA	100	Temporarily re-assemble parts called out in operation 40. With Seat Panel secured in position line drill thru (10) holes in Seat Panel, (5) thru each side panel to a depth of .61 using a #7 drill.							
PA	110	Remove Seat Panel and tap (5) holes in each Side Panel with a #10x32 Helicoil Tap.							
QC	115	First piece inspection and subsequent spot check operations 90 thru 110.							

NADC-80208-60

111AD0907-258 SHEET

STERLING AUTO ENGINEERING CORPORATION
a LALLY INDUSTRIES Company

PRODUCTION ROUTE CARD

ASSEMBLY PART NO X16100

ASSEMBLY NAME MPES - Seat Bucket Assy.

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 5 OF 9

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER TOOL	MANHOURS INSP HR	MANHOURS INSP TOOL	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF TIME
PA	120	Install (10) inserts (MS21209F1-20) wet with primer, (5) in each Side Panel.							
PA	130	Locate Closure (16180-11) between side panels and back panel as shown in drawing Zones B5 and D7. Clamp in position and drill (17) holes (155-161) using a #21 drill thru (3) Pilot Holes in Back Panel. Deburr holes as required and temporarily bolt closure in place							
PA	140	Position and clamp Sup. Channel (16181-11) between side panels and under flange of closure as shown in drawing Zone B5 and install Seat Panel in place. Drill (4) holes thru closure and Supt. Channel using (4) Back holes in Seat Panel as guide. Drill using a #7 Drill. Remove Closure and Supt. Channel and deburr holes as required.							
PA	150	Install (4) Floating Nuts (FFN6010-10-C) in Supt. Channel.							
PA	160	Reinstall Closure and Supt. Channel and secure in place thru back holes in Seat Panel, while secured in place drill thru (2) holes (.250 - .255) in each side panel thru supt. channel as shown in drawing Zone B5.							
PA	170	Remove Supt. Channel deburr holes as required and install (4) Floating Nuts (FFN6010-12-C) (2) each end of channel.							
QC	175	First piece inspection and subsequent spot check operations 120 thru 170.							

SIERRACIN ACOUSTIC ENGINEERING CORPORATION
a TALLY INDUSTRIES Company

PRODUCTION ROUTE CARD

PART NO
ASSEMBLY NAME MPES - Seat Bucket Assy.

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 6 OF 9

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER TOOL	MANHOURS INSP HR	MANHOURS INSP TOOL	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF QC
		OPERATION							
PA	180	Permanently install front panel assy. to each side panel assy, using (10) Bolts (NAS6203-11) and (10) Washers (AN960-C10L)							
PA	190	Permanently install Back Panel Assy. between Side Panels using (6) Bolts (NAS6205-11) and (6) Washers (AN960-C516L) to top of each Side Panel; and (8) Bolts (NAS6203-11) and (8) Washers (AN960-C10L) down side of each side panel as shown in drawing Zone 5.							
PA	200	Permanently install Seat Panel Assy. in place using (14) Screws (MS24694-S56) wet with primer.							
PA	210	Locate Closure and secure to back panel with (11) Rivets (MS20470-AD5) wet with primer.							
PA	220	Locate Supt. Channel (16181-11) and secure Supt. Channel and Closure to seat Panel with (4) Screws (MS24694-62) wet with primer. Secure Supt. Channel to Side Panels with (1) Bolt (NAS6204-11) and (1) Washer (AN960-C416L) thru each side panel.							
PA	230	Secure Closure to each side panel with (3) Rivets (MS20470-AD5) wet with primer.							
QC	235	First piece inspection and subsequent spot check operations 180 thru 230.							
PA	240	Locate and align Motor Supt. Plate (16140-1) on bottom of side panels, Front Panel and Back Panel. Drill thru (25) existing holes in Motor Supt. Plate using a #7 drill. Drill (8) holes into each side panel to a depth of .61; Drill (5) holes into Front Panel to a depth of .55; Drill (4) holes into back panel to a depth of .55.							

STENCEL AERO ENGINEERING CORPORATION
a RATTY INDUSTRIES Company

PRODUCTION ROUTE CARD

PART NO
ASSEMBLY NAME MPES - Seat Bucket Assy.

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 7 OF 9

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER TOOL HR	MANHOURS INSP HR	MANHOURS INSP TOOL HR	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF TIME
PA	250	Remove Motor Supt. Plate and tap (25) holes drilled in operation 240 with a #10-32 helicoil tap.							
PA	260	Install (25) Inserts (MS21209-F1-20) wet with Primer.							
QC	265	First piece inspection and subsequent spot check operations 240 thru 260.							
PA	270	Install Motor Supt. Plate using (25) Bolts (NAS6203-4) and (25) Washers (AN960-C10L) as shown in drawing Zone A6.							
PA	280	Install Brace Assy. (16190-1) as shown in drawing Zone B3 using (4) Bolts (NAS6203-11) and (4) Washers (AN960-10L).							
PA	290	Position GFE Fittings at top of Back Panel and side panels as shown in drawing Zone D3. Measure distance from fitting surface to fitting surface and make Shims (16100-15) as shown in drawing Zone C5 to achieve a distance of 16.00 inches from surface to surface							
PA	300	Identify Shims with Seat serial number to be shipped with seats.							
PA	310	Relocate GFE Fittings and Shims on 1st Seat and Seat to be shipped to China Lake and drill (8) holes thru Fitting, (4) thru side panel and (4) thru Back Panel using 1/4 inch drill. Deburr holes as rquired.							

a LITTON INDUSTRIES Company

PRODUCTION ROUTE CARD

ASSEMBLY NAME: MPES - Seat Bucket Assy.

JOB ORDER NO.

PRODUCTION ORDER NO.

OPERATION			MANHOURS				SIGN OFF		
			OPER		INSP				
DEPT	OPER	OPERATIONS INSTRUCTION	HR	10th	HR	10th	OPER	INSP	LEAD
QC	315	First piece inspection and subsequent spot check operations 270 thru 310.							
PA	320	Secure GFE Fittings on sturcture going to China Lake with Shims (16100-15), (16) Bolts (NAS6204-17) and (32) Washers (AN960-C416L)							
PA	330	Bond (2) Hook Fasteners (16100-11) and (1) Hook Fastener (16100-13) to Seat Panel Assy. as shown in drawing Zone C7. Locate from Seat Cushion (16171-1) with Cushion flush with front edge of seat panel.							
PA	340	Paint exposed surfaces of guide rails with code 6 per SAEC STD. 111EPS919-004.							
PA2	350	Locate seat cushion (16171-1) on seat panel assy.							
QC	355	First piece inspection and subsequent spot check operations 320 thru 350.							
PC	360	Serialize and identify seat bucket assy. per SAEC STD. 111PPP947-005, Class 20.							
QC	365	Final Acceptance: 1. Verify all operations complete 2. Verify Bucket Structures conform to drawing requirements.							

SIKORSKY AERO ENGINEERING CORPORATION
a TALLEY INDUSTRIES Company

PRODUCTION ROUTE CARD

ASSEMBLY PART NO: 41b100
ASSEMBLY NAME: MPES - Seat Bucket Assy.

JOB ORDER NO.

PRODUCTION ORDER NO.

SHEET 9 OF 9

OPERATION			MANHOURS				SIGN OFF		
			OPER		INSP				
DEPT	OPER	OPERATIONS INSTRUCTION	HR	TOTL	HR	TOTL	OPER	INSP	ITM
PC	370	Route Seat Bucket Structures to Shipping along with appropriate (16100-15) Shims to be shipped together to their destination.							

NADC-80208-60

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111AD907-258 SHEET

SIERRA AUTO ENGINEERING CORPORATION
a TALLY INDUSTRIES Company

PRODUCTION ROUTE CARD

JOB ORDER NO. _____ PRODUCTION ORDER NO. _____ SHEET 1 OF 7

ASSY PART NO 16110-1	DWG REV N/R	LOT NO	QTY PER W O
DESCRIPTION Back Panel Assy. - MPES			QTY ACCEPT
NEXT ASSY PART NO 16100	QTY PER NEXT ASSY 1(-1)		QTY REJECT
ASSY SERIAL NO(S)			
EFFECTIVITY			

NOTES Holes in Frame members (-19,-20 & -23) will be located from adjoining parts. Heli-Coils (MS21209-F1-20) Will be installed at that time

PREPARED D. Wilson DATE 4/3/80
APPROVED SYS. _____ DATE
Q.A. _____ DATE 4-3-80

REVISIONS

PRC REV	DWG REV	REASON FOR CHANGE	OPERATIONS AFFECTED	DATE	PREP BY	APPR BY

DATE W O ISSUED		REQ COMP DATE	
ISSUED BY		RECEIVED BY	
DATE W O RECD		DATE W O COMP	
ACCEPTED (QC)		ACCEPTANCE DATE	
TOTAL TIME		UNIT TIME	

ASSEMBLY/PARTS LIST PARTS ISSUED BY

ITEM NO	QTY ASSY	QTY W O	QTY ISS'D	DATE / BY	PART NUMBER	REV	PART NAME/MATERIAL	MATERIAL SIZE	MATERIAL SPEC	RAW MATL /CERT NO
1	1				-11		Face Sheet, FWD.			
2	1				-13		Face Sheet, AFT.			
3	1				-15		Core, Upper			
4	1				-17		Core, Lower			
5	1				-19		Frame, L.H.			
6	1				-20		Frame, R.H.			
7	1				-21		Insert, Plate			
8	1				-23		Frame, Bottom			
9	11				-25		Insert			
10	2				-27		Insert (Blocks)			
11	4				MS21209-F1-20		Heli-Coil (Addn'l 16 to installed on next assy.)			
12	12				MS21209-F5-20		Heli-Coil			

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NADC-80208-60

ST EL AERO ENGINEERING CORPORATION
a TALLEY INDUSTRIES Company

ASSEMBLY PART NO 16110-1

SHEET 2 OF 7

PRODUCTION ROUTE CARD

JOB ORDER NO. _____ PRODUCTION ORDER NO. _____

ASSEMBLY/PARTS LIST

ITEM NO	QTY ASSY	QTY W O	QTY ISS'D	DATE / BY	PART NUMBER	REV	DESCRIPTION	REMARKS
13	4				MS24694-52		Screw	
14	AR				R-393-1		Adhesive	
15	AR				R-370-B		Adhesive	
16	AR				R-371		Edge Filler (with catalyst)	
17	AR				R-500		Primer	

111A00907-258 SHEET

a TALLY INDUSTRIES Company

PRODUCTION ROUTE CARD

PART NO

ASSEMBLY NAME: Back Panel Assy. - MPES

JOB ORDER NO.

PRODUCTION ORDER NO.

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER 10th	MANHOURS INSP HR	MANHOURS INSP 10th	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF TIME
PA	10	With skin (-13) in place, locate and fit frame members (-19, -20, & -23) and Plate (-21) Steel stamp identify members for future assy. With transfer punch, mark, location of attach holes on -19, -20, & -23) from Bonding fixture. Drill and tap #6 - 32 x 1/4 two places on each frame member (-19, -20 & -23). (NOTE: TAPPED HOLES ARE FOR TEMPORARY USE IN FIXTURE AND ARE IN PROPER LOCATION. THESE HOLES WILL LATER BE OBLITERATED BY HELICOIL TAP - SEE NOTE, Pg. 1.)							
PA	20	Fit and identify skins (-11 & -13) with steel stamp in inconspicuous location.							
PA	25	Verify cleaning solutions concentrations and temperatures.							
PA	30	Clean parts in the following manner: All parts except Core pieces- 1. Degrease with Kimwipes saturated with MEK. 2. Clean with Oakite cleaner at STD. concentration and 140°F. to 150°F. for 10 - 15 minutes. 3. Rinse in cold flowing water for 3 minutes. 4. Check for water break free film. If water break occurs, repeat #2 & #3. 5. Immerse for 10 - 11 minutes in 140°F. to 160°F. solution of Sulphuric Acid (32.3 - 40.0 oz. wt.) and Sodium Dichromate (3.3 - 4.7 oz. wt.) with water to make one gallon solution. 6. Rinse with cold flowing water for 3 minutes. 7. Check for water break free film. If water break occurs, Repeat #5 & #6.							

-Continued-

a LITTY INDUSTRIES Company

PRODUCTION ROUTE CARD

PART NO 16110-1

ASSEMBLY NAME Back Panel Assy. - MPES

JOB ORDER NO.

PRODUCTION ORDER NO.

SHEET 4 OF 7

DEPT	OPER	OPERATION OPERATIONS INSTRUCTION -Continued-	MANHOURS OPER HR	MANHOURS OPER 10th	MANHOURS INSP HR	MANHOURS INSP 10th	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF TIME
A	30	8. Rinse with hot flowing water (approx. 140°F.). 9. If water break occurs, repeat #5, #6 & #7. 9. Air dry. NOTE: ONCE CLEANING PROCESS BEGINS, PARTS MUST NOT BE TOUCHED WITH BARE HANDS. USE RUBBER GLOVES FOR WET PARTS CLEAN COTTON GLOVES THEREAFTER. 10. Wrap parts individually in Kraft paper.							
C	3	Verify above.							
A	40	Mask outer edge of frame members (-19, -20, & -23). Mask area of 6 holes (5/16 Helicoils) on -21 plate. Mask one edge of -27 blocks. Apply reliabond R-500 Primer to above parts, to nunbered side of skins (-11 & -13), and to -25 Inserts. Air dry for 30 minutes and oven cure for 30 minutes at 235°F. to 250°F. Upon removal from oven, rewrap in Kraft paper. NOTE: NO MORE THAN 16 HOURS SHOULD ELAPSE BETWEEN CLEANING AND PRIMING.							
C	45	Verify above.							
	50	Clean Core pieces (-15 & -17) by immersing in MEK and allowing to drain dry. Wrap pieces individually in Kraft paper. Handle with clean cotton gloves.							

LITTLY INDUSTRIES Company

PRODUCTION ROUTE CARD

PART NO 10110-1

ASSEMBLY NAME Back Panel Assy. - MPES

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 5 OF 7

OPERATION			MANHOURS				SIGN OFF		
			OPER		INSP				
EPT	OPER	OPERATIONS INSTRUCTION	HR	10th	HR	10th	OPER	INSP	TIME
C	55	Verify Above							
A	60	Clean bonding fixture with Kimwipe saturated with MEK. When dry, apply spray - on mold release.							
A	70	Remove both film adhesives from freezer. Allow to reach room temperature before unrolling. Apply film adhesive (R-393-1) to -13 skin. (on primed side) and trim off excess. Assemble -13 skin into bonding fixture. Assemble (4) HeliCoils (MS21209-F1-20)to tapped holes in tabs on -21 plate. (Assemble wet with primer.)							
A	80	Assemble -19 & -20 Frames to -21 Plate using (1) Screw (MS24694-52) in each top hole. (NOTE: CHECK POSITION OF -21 PLATE AGAINST DRAWING. IT IS NON-SYMENTRICAL.)							
A	90	Place above assy. into fixture. Secure with (2) #10-32 x 3/4 Screw in vacant holes on tabs of -21 Plate and with (2) #6-32 x 3/8 Screws in each frame member (-19 & -20). Place .032 shims in upper and lower. position on each side.							
A	100	Assemble -23 Bottom Frame to fixture and secure with (2) #6-32x3/4" Screws. Cut R-370-B film adhesive into strips approx. 3/4" wide. Place strips on inner edge of -19, -20 & -23 Frames. Place strips on Upper and Lower edges of -21 Plate. Place -15 & -17 Core pieces in position. Wrap each -25 Insert with a strip of R-370-B, assemble onto dowel pin in fixture and into core. Place strip of R-370-B on (3) sides of -27 Insert and place -27 into position in Core. Apply film adhesive (R-393-1) to -11 skin, trim excess and place on top of already assembled parts. Prepare test coupon and place in central cavity of Back Panel. Place top							

-Continued-

a TALLY INDUSTRIES Company

PRODUCTION ROUTE CARD

ASSEMBLY NAME: Back Panel Assy. - MPES

JOB ORDER NO. _____ PRODUCTION ORDER NO. _____ SHEET 6 OF 7

DEPT	OPER	OPERATION — OPERATIONS INSTRUCTION (Continued)	MANHOURS OPER HR	MANHOURS OPER 10th	MANHOURS INSP HR	MANHOURS INSP 10th	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF TIME
A	100	plate on bonding fixture, secure with bolts and tighten uniformly.							
		NOTE: UNTIL FIXTURE IS CLOSED, CLEAN WHITE COTTON GLOVES MUST BE WORN.							
QC	105	Verify above.							
PA	110	Attach thermocouple leads and place loaded fixture in oven to cure at 250°F. - 260°F.							
&A	120	tor temperature and notify assembly personnel when 60 minutes 50°F. has elapsed. Provide strip recorder printout and attach to this P.R.C.							
QC	125	Verify above.							
A	130	Remove from oven, allow to air cool. Disassemble fixture and remove bonded assy. Hold test coupon for QC disposition.							
	140	Assemble (2) Screws (MS24694-52) in vacant holes to secure -19 & -20 frames to -21 plate. Install (12) Helicoils (MS21209-E5-20) wet with primer into tapped holes on sides of -21 plate.							
	150	Mix R-371 Edge Filler with catalyst per manufacturer's instructions. Fill exposed edges at top of Back Panel and around periphery of opening in center of Panel. After curing, sand smooth all edges. Break edges of -11 & -13 skin around riser strap slot at top of Panel.							

PRODUCTION ROUTE CARD | NAME: Back Panel Assy. - MPES

JOB ORDER NO. | PRODUCTION ORDER NO. | SHEET 7 OF 7

OPERATION				MANHOURS				SIGN OFF		
				OPER		INSP				
DEPT	OPER	OPERATIONS INSTRUCTION		HR	10th	HR	10th	OPER	INSP	TIME
QC	155	FINAL ACCEPTANCE: 1. Verify all operations completed. 2. Verify test coupon as required. 3. Verify parts conform to drawing requirements. (See Note, Pg. 1 of this P.R.C.)								
PC	160	Hold for next assy.								

111AD0907-258 SHEET 3

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NADC-80208-60

a TALLY INDUSTRIES Company

JOB ORDER NO. _____ PRODUCTION ORDER NO. _____ SHEET 1 OF 9

ASSY PART NO	16120-1	DWG REV B	LOT NO
DESCRIPTION	Side Panel Assy. (L.H.) MPES		
NEXT ASSY PART NO	16100	QTY PER NEXT ASSY	1(-1)
ASSY SERIAL NO(S)			
EFFECTIVITY	001-004		

QTY PER W O

QTY ACCEPT

QTY REJECT

NOTES Holes for attaching Seat Pan and Motor Support Plate will be located, drilled and tapped on final assembly. The (12) Heli-Coils (MS21209-F1-20) will be put in at that time.

PREPARED D. Wilson DATE 4/30/80

APPROVED SYS. _____ DATE _____

Q.A. [signature] DATE 5-6-80

REVISIONS

PRC REV	DWG REV	REASON FOR CHANGE	OPERATIONS AFFECTED	DATE	PREP BY	APPR BY

DATE W O ISSUED		REQ COMP DATE	
ISSUED BY		RECEIVED BY	
DATE W O RECD		DATE W O COMP	
ACCEPTED (QC)		ACCEPTANCE DATE	
TOTAL TIME		UNIT TIME	

ASSEMBLY/PARTS LIST PARTS ISSUED BY _____

ITEM NO	QTY ASSY	QTY W O	QTY ISS'D	DATE / BY	PART NUMBER	REV	PART NAME/MATERIAL	MATERIAL SIZE	MATERIAL SPEC	RAW MATL /CERT NO
							** See Sheet 2**			

111ADD907-250 SHEET 1 OF 3

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NADC-80208-60

STENCEL AERO ENGINEERING CORPORATION
a TALLEY INDUSTRIES Company

ASSEMBLY PART NO 16120-1

SHEET 2 OF 9

PRODUCTION ROUTE CARD

JOB ORDER NO. _____ PRODUCTION ORDER NO. _____

ASSEMBLY/PARTS LIST

ITEM NO	QTY ASSY	QTY W O	QTY ISS'D	DATE / BY	PART NUMBER	REV	DESCRIPTION	REMARKS
1	1				-11		Skin - Outer, L.H.	
2	1				-13		Skin-Inner L.H.	
3	3				-15		Insert, Blank	
4	1				-17		Rail, L.H.	
5	2				-19		Doubler, Upper	
6	1				-21		Doubler, Corner, Outer	
7	1				-23		Doubler, Corner, Inner	
8	2				-25		Doubler, Forward	
9	1				-27		Core, Forward	
10	1				-29		Core, Center	
11	1				-31		Core, Upper	
12	1				-33		Frame, Belt Attach. (Dogbone)	
13	1				-35		Frame, Forward	
14	1				-37		Frame, Bottom L.H.	
15	1				-39		Frame, Upper	
16	1				-41		Boss, Plain	
17	1				-43		Boss, Tapped	
18	46				MS20470-AD5		Rivet	
19	12				MS21209-F1-20		Heli-Coils (To be installed on next assy.)	
20	1				MS21209-F4-20		Heli-Coil	
21	1				MS27039-1-18		Screw	
22	AR				R-393-1		Adhesive	
23	AR				R-370-13		Adhesive, Foaming	
24	AR				R-371		Edge Filler (with Catalyst)	
25	AR				R-500		Primer	

SPENCER AERO ENGINEERING CORPORATION
a TEXTRON INDUSTRIES Company

PRODUCTION ROUTE CARD

ASS'Y PART NO 16120-1
ASSEMBLY NAME Side Panel Assy.- MPES

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 3 OF 9

OPERATION			MANHOURS				SIGN OFF		
			OPER		INSP				
DEPT	OPER	OPERATIONS INSTRUCTION	HR	10th	HR	10th	OPER	INSP	TIME
PA	10	With Doublers (-19,-23&-25) in place, locate and fit the following components into the bonding fixture: -17 Rail -33 Frame, Belt Attach (Dogbone) -35 Frame, Forward -37 Frame, Bottom, L.H. -39 Frame, Upper With transfer punch, mark location of attach. holes on -33, -37 & -39. Drill and tap #6-32 x 1/4" at each location. (NOTE: TAPPED HOLES ARE FOR TEMPORARY USE IN FIXTURE. THESE HOLES WILL LATER BE OBLITERATED BY HELI-COILS TAP- See Note Pg. 1)							
PA	20	Mark location of MS27039-1-18 screw between -35 & -33. Drill and tap #10-32 into -33 (Dog bone) Tapped hole should be approx. 1/8" short of going thru. Drill #7 clearance hole in -35 Forward Frame. Temporarily assemble -33 & -35 for further fit-up to fixture.							
PA	30	With transfer punch, mark location of dowel pin holes in -17 Rail, & -35 Forward Frame & -37 Bottom Frame, locate from holes in fixture. Drill 9/64 holes at these locations.							
PA	40	In inconspicuous location, steel stamp identify all frames, doublers and skins for future reference, and remove from fixture.							

LITTON AUTO ENGINEERING CORPORATION
a LITTON INDUSTRIES Company

PRODUCTION ROUTE CARD

PART NO 10120-1
ASSEMBLY NAME Side Panel Assy. (L.H.)

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 4 OF 9

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER 10th	MANHOURS INSP HR	MANHOURS INSP 10th	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF ITEM
PA	50	Press -41 Boss, Plain and -43 Boss, Tapped into -33 Dog Bone, -41 Boss goes in Upper hole -43 goes in lower hole. Head of boss should be flush or slightly below flush with inside surface of Dog Bone. If not, partially press out and file or sand head and repress into position.							
PA	60	Prepare test coupons. (Three are required for each assy) Skins should be 1 1/2" x 4" of .020 thick 7075-T73 alum. Cores should be of same core material as used on side panel and should be 1 1/2" x 3".							
		Once weekly prior to bonding an assembly, lap Shear Test Coupons are to be bonded to verify adhesive strength. Coupons should be made of adhesive strength. Coupons should be made of aluminum of .050" or greater, and should be 1 1/2" wide by 2" to 4" long. Coupons are to be lapped 1/2" end to end and bonded.							
QC	65	Verify above and verify cleaning solutions concentrations and temperatures.							
PA	70	Clean all parts except core pieces as follows: 1. Degrease with Kimwipes saturated with MEK. 2. Clean with Oakite cleaner at STD concentration and 140°F. - 150°F. for 10 - 15 minutes. 3. Rinse in cold flowing water for 3 minutes. 4. Check for water break free film. If water break occurs, repeat #2 & #3. 5. Immerse for 10 - 11 minutes in 140°F. to 150°F. solution of of Sulphuric Acid (32.3 - 40.0 oz. wt.) and Sodium Dichromate (3.3 - 4.7 oz. wt.) with water to make one gallon solution. 6. Rinse with cold flowing water for 3 minutes. 7. Check for water break free film. If water break occurs, repeat #5 & #6.							

-Continued-

SPICER AUTO ENGINEERING CORPORATION
a TALLY INDUSTRIES Company

PRODUCTION ROUTE CARD

ASSY PART NO. 16 1

ASSEMBLY NAME Side Panel Assy. - MPES

JOB ORDER NO.

PRODUCTION ORDER NO.

SHEET 5 OF 9

DEPT	OPER	OPERATIONS INSTRUCTION -Continued-	MANHOURS OPER HR	MANHOURS OPER MCH	MANHOURS INSP HR	MANHOURS INSP MCH	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF
PA	70	8. Rinse with hot flowing water (approx. 140°F.) If water break occurs, repeat #5, #6 & #7.							
		9. Air dry.							
		NOTE: ONCE CLEANING PROCESS BEGINS, PARTS MUST NOT BE TOUCHED WITH BARE HANDS. USE RUBBER GLOVES FOR WET PARTS AND CLEAN WHITE COTTON GLOVES THEREAFTER.							
		SHOP AIR CONTAINS OIL VAPOR - DO NOT BLOW PARTS DRY!							
		10. Wrap parts on Kraft paper.							
QC	75	Verify above.							
PA	80	Mask parts as follows: 1. -17 Rail - Mask area which will protrude beyond skins. 2. -33 Dog Bone - Mask protruding ends of Bosses. 3. -35 Front Frame - Mask forward edge above Dog Bone attach hole. 4. -37 Bottom Frame - Mask lower edge. 5. -39 Upper Frame- Mask upper edge.							
PA	90	Apply Reliabond R-500 Primer to all surfaces not masked on all frames and inserts. Apply to skins and doublers as follows: 1. -11 & -13 Skins - Prime both sides 2. -19,-21,-23 & -25 - Prime numbered side. Air dry for 3 minutes, remove masking wrap as required, at 235 °F. Upon removal from oven batch parts into sets and wrap in Kraft paper. NOTE: NO MORE THAN 16 HOURS SHOULD ELAPSE BETWEEN CLEANING AND PRIMING.							

111AD0907-25B SHEET

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NADC-80208-60

SIKORSKY AIRCRAFT ENGINEERING CORPORATION
a TALLY INDUSTRIES Company

PRODUCTION ROUTE CARD

ASSY PART NO 16120-1

ASSEMBLY NAME Side Panel Assy. - MPES

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 6 OF 9

OPERATION			MANHOURS				SIGN OFF		
			OPER		INSP				
DEPT	OPER	OPERATIONS INSTRUCTION	HR	TOOL	HR	TOOL	OPER	INSP	TIME
QC	95	Verify above.							
PA	100	Clean Core pieces (-27,-29 & -31) by immersing in MEK and allowing to drain dry. Wrap pieces in Kraft paper. Handle with clean white cotton gloves.							
QC	105	Verify above.							
PA	110	Clean bonding fixture with Kimwipe saturated with MEK. When dry, apply mold release compound to required areas.							
PA	120	Remove adhesives (R-393-1 & R-370-B) from freezer. Allow to thaw before unrolling to avoid cracking. NOTE: Clean white cotton gloves required for the following operations 130 thru 140. NOTE: Q.C. witness oper. 130.							
PA	130	Cut pieces of adhesive R-393-1 to match each skin and each doubler. NOTE: ADHESIVE MAY BE PIECED TOGETHER IF NEEDED, BUT JOINT SHOULD BE TIGHT. LAY UP ASSEMBLY IN THE FOLLOWING ORDER: 1. Place -25 Forward Doubler in position over .012 Brass Shim, prime side up. 2. Place -23 Corner Doubler in position prime side up. 3. Place -19 Upper Doubler in position, prime side up.							

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER 10th	MANHOURS INSP HR	MANHOURS INSP 10th	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF ENG
PA	130	Continued							
		4. Peel backings from R-393-1 film adhesive pieces that were pre-cut and place on each of the three doublers.							
		5. With Upper Spacer in correct position on fixture, place -13 skin in position.							
		6. Peel backings from R-393-1 film adhesive piece pre-cut and place on top of skin.							
		7. Pre-assemble -33 Dog Bone to -35 Forward Frame with MS27039-1-18 Screw and place in position.							
		8. Place -39 Upper Frame in position and secure it and Dog Bone to fixture with #6-32 screws.							
		9. Place -17 Rail in position.							
		10. Place -37 Bottom Frame in position and secure to fixture with #6-32 screws.							
		11. Cut R-370-B foaming adhesive into strips approximately 1/2" wide. Apply these strips to inside edges of Rail and all frame members.							
		12. Place Core pieces into position.							
		13. Wrap each -15 Insert with strip of R-370-B adhesive and place insert into position in Forward Core.							
		14. Peel backings from R-393-1 film adhesive pre-cut and place in position on top of assembly.							
		15. Place -11 skin on top of assembly.							
		16. Peel backings from R-393-1 film adhesive pre-cuts and place in position on skin.							
		17. Place -25 Forward Doubler in position primed side down.							
		18. Place -21 Corner Doubler in position, primed side down.							
		19. Place -19 Upper Doubler in position, primed side down							
		20. Make up test coupons and place in position on fixture.							
QC	135	Verify operation 130.							

SIKORSKY AERO ENGINEERING CORPORATION
a LITTON INDUSTRIES Company

PRODUCTION ROUTE CARD

PART NO [illegible]
ASSEMBLY NAME Side Panel Assy. -MPES

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 8 OF 9

OPERATION				MANHOURS				SIGN OFF		
				OPER		INSP				
DEPT	OPER	OPERATIONS INSTRUCTION		HR	TOTAL	HR	TOTAL	OPER	INSP	ITEM
PA	140	Verify dowel pin holes are aligned. Place upper and lower clamp plates on fixtue. Put 1/8" dia x 1 1/2" wooden dowels in place. Verify that fixture spacer plates are seated between Doublers and not riding on edge of Doublers. Assemble clamp bolts and tighten uniformly.								
QC	145	Verify above.								
PA	150	Attach thermocouple leads and place loaded fixture in oven. Set oven thermostat for 250°F. to 260°F.								
T&A	160	Monitor temperature and notify assembly personnel when 60 minutes at 250°F. has elapsed. Provide strip recorder print-out and attach to this PRC.								
QC	165	Verify above.								
PA	170	Remove from oven and allow to air cool. Disassemble fixture and remove bonded assy. Hold test coupons for QC disposition.								
PA	180	Locate and mark holes for rivets thru rail. Drill each with #21 drill. Assemble rivets, MS20470-AD5, head out, and set.								
PA	190	Install (1) Heli-Coil, MS21209-F4-20, wet with primer, into lower Boss								

[illegible] SHEET

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NADC-80208-60

A TALLY INDUSTRIES Company

PRODUCTION ROUTE CARD

JOB ORDER NO.

PRODUCTION ORDER NO.

SHEET 1 OF 9

ASSY PART NO 16120-2	DWG REV B	LOT NO	QTY PER W O
DESCRIPTION Side Panel Assy. (R.H.) MPES			QTY ACCEPT
NEXT ASSY PART NO 16100		QTY PER NEXT ASSY	QTY REJECT
ASSY SERIAL NO(S)			
EFFECTIVITY 001-004			

NOTES Holes for attaching Seat Pan and Motor Support Plate will be located, drilled and tapped on final assembly. The (12) Heli-Coils (MS21209-F1-20) will be put in at that time.

DATE W O ISSUED		REQ COMP DATE	
ISSUED BY		RECEIVED BY	
DATE W O RECD		DATE W O COMP	
ACCEPTED (QC)		ACCEPTANCE DATE	
TOTAL TIME		UNIT TIME	

PREPARED D. Wilson DATE 5/1/80

APPROVED SYS. DATE

Q.A. DATE 5-6-80

REVISIONS

PRC REV	DWG REV	REASON FOR CHANGE	OPERATIONS AFFECTED	DATE	PREP BY	APPR BY

ASSEMBLY/PARTS LIST PARTS ISSUED BY

ITEM NO	QTY ASSY	QTY W O	QTY ISS'D	DATE / BY	PART NUMBER	REV	PART NAME/MATERIAL	MATERIAL SIZE	MATERIAL SPEC	RAW MATL/CERT NO
							** See Sheet 2**			

NADC-80208-60

STENCEL AERO ENGINEERING CORPORATION
a TALLEY INDUSTRIES Company

ASSEMBLY PART NO 16120-2

SHEET 2 OF 9

PRODUCTION ROUTE CARD

JOB ORDER NO. _____ PRODUCTION ORDER NO. _____

ASSEMBLY/PARTS LIST

ITEM	QTY ASSY	QTY W O	QTY ISS'D	DATE / BY	PART NUMBER	REV	DESCRIPTION	REMARKS
	1				-12		Skin - Outer, R.H.	
	1				-14		Skin - Inner R.H.	
	3				-15		Insert, Blank	
	1				-18		Rail, R.H.	
	2				-19		Doubler, Upper	
	1				-22		Doubler, Corner, Outer	
	1				-24		Doubler, Corner, Inner	
	2				-25		Doubler, Forward	
	1				-27		Core, Forward	
	1				-29		Core, Center	
	1				-31		Core, Upper	
	1				-34		Frame, Belt Attach. (Dogbone)	
	1				-35		Frame, Forward	
	1				-38		Frame, Bottom R.H.	
	1				-39		Frame, Upper	
					-41		Boss, Plain	
	1				-43		Boss, Tapped	
	25				MS20470-AD5		Rivet	
	12				MS21209-F1-20		Heli-Coils (To be installed on next assy.)	
	1				MS21209-F4-20		Heli-Coil	
	1				MS27039-1-18		Screw	
	AR				R-393-1		Adhesive	
	AR				R-370-13		Adhesive, Foaming	
	AR				R-371		Edge Filler (with Catalyst)	
	AR				R-500		Primer	

PRODUCTION ROUTE CARD

ASSEMBLY NAME: Side Panel Assy. - MPES

JOB ORDER NO.

PRODUCTION ORDER NO.

OPERATION			MANHOURS				SIGN OFF		
			OPER		INSP				
DEPT	OPER	OPERATIONS INSTRUCTION	HR	TOOL	HR	TOOL	OPER	INSP	TIME
PA	10	With Doublers (-19, -24 & -25) in place, locate and fit the following components into the bonding fixture: -18 Rail -34 Frame, Belt Attach (Dogbone) -35 Frame, Forward -38 Frame, Bottom R.H. -39 Frame, Upper With transfer punch, mark location of attach. holes on -34 -38 & -39. Drill and tap #6-32 x 1/4" at each location. (NOTE: TAPPED HOLES ARE FOR TEMPORARY USE IN FIXTURE. THESE HOLES WILL LATER BE OBLITERATED BY HELI-COILS TAP - See Note Pg. 1)							
PA	20	Mark location of MS27039-1-18 screw between -35 & -34. Drill and tap #10-32 into -34 (Dog bone). Tapped hole should be approx. 1/8" short of going thru. Drill #7 clearance hole in -35 Forward Frame. Temporarily assemble -34 & -35 for further fit-up to fixture.							
PA	30	With transfer punch, mark location of dowel pin holes in -18 Rail, & -35 Forward Frame & -38 Bottom Frame, locate from holes in fixture. Drill 9/64 holes at these locations.							
PA	40	In inconspicuous location, steel stamp identify all frames, doublers and skins for future reference, and remove from fixture.							

111AD0907-258 SHEET

PRODUCTION ROUTE CARD

ASSEMBLY NAME: Side Panel Assy. (R.H.) MPES

JOB ORDER NO.

PRODUCTION ORDER NO.

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER TOOL	MANHOURS INSP HR	MANHOURS INSP TOOL	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF LEAD
PA	50	Press -41 Boss, Plain and -43 Boss, Tapped into -34 Dog Bone; -41 Boss goes in Upper hole, -43 goes in lower hole. Head of boss should be flush or slightly below flush with inside surface of Dog bone. If not, partially press out and file or sand head and repress into position.							
PA	60	Prepare test coupons. (Three are required for each assy.) Skins should be 1 1/2" x 4" of .020 thick 7075-T73 alum. Cores should be of same core material as used on side panel and should be 1 1/2" x 3". Once weekly prior to bonding an assembly, lap Shear Test Coupons are to be bonded to verify adhesive strength. Coupons should be made of adhesive strength.. Coupons should be made of aluminum of .050" or greater, and should be 1 1/2" wide by 2" to 4" long. Coupons are to be lapped 1/2" end to end and bonded.							
QC	65	Verify above and verify cleaning solutions concentrations and temperatures.							
PA	70	Clean all parts except core pieces as follows: 1. Degrease with Kimwipes saturated with MEK. 2. Clean with Oakite cleaner at STD concentration and 140°F. - 150°F. for 10 - 15 minutes. 3. Rinse in cold flowing water for 3 minutes. 4. Check for water break free film. If water break occurs, repeat #2 & #3. 5. Immerse for 10 - 11 minutes in 140°F. to 150°F. solution of Sulphuric Acid (32.3 - 40.0 oz. wt.) and Sodium Dichromate (3.3 - 4.7 oz. wt.) with water to make one gallon solution. 6. Rinse with cold flowing water for 3 minutes. 7. Check for water break free film. If water break occurs, repeat #5 & #6.							

-Continued-

a TATTY INDUSTRIES Company

PRODUCTION ROUTE CARD

ASSEMBLY NAME: Side Panel Assy. - MPES

JOB ORDER NO.

PRODUCTION ORDER NO.

DEPT	OPER	OPERATION / OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER TOTH HR	MANHOURS INSP HR	MANHOURS INSP TOTH HR	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF TP
		-Continued-							
PA	70	8. Rinse with hot flowing water (approx. 140°F.) If water break occurs, repeat #5, #6 & #7.							
		9. Air dry.							
		NOTE: ONCE CLEANING PROCESS BEGINS, PARTS MUST NOT BE TOUCHED WITH BARE HANDS. USE RUBBER GLOVES FOR WET PARTS AND CLEAN WHITE COTTON GLOVES THEREAFTER. SHOP AIR CONTAINS OIL VAPOR - DO NOT BLOW PARTS DRY!							
		10. Wrap parts on Kraft paper.							
QC	75	Verify above.							
PA	80	Mask parts as follows: 1. -18 Rail - Mask area which will protrude beyond skins. 2. -34 Dog Bone - Mask protruding ends of Bosses. 3. -35 Front Frame - Mask forward edge above Dog Bone attach hole. 4. -38 Bottom Frame - Mask lower edge. 5. -39 Upper Frame - Mask upper edge.							
PA	90	Apply Reliabond R-500 Primer to all surfaces not masked on all frames and inserts. Apply to skins and doublers as follows: 1. -12 & -14 Skins - Prime both sides. 2. -19, -22, -24 & -25 - Prime numbered side. Air dry for 3 minutes, remove masking wrap as required, at 235°F. Upon removal from oven batch parts into sets and wrap in Kraft paper. NOTE: NO MORE THAN 16 HOURS SHOULD ELAPSE BETWEEN CLEANING AND PRIMING.							

GRUMMAN AEROSPACE CORPORATION
a GRUMMAN INDUSTRIES Company

PRODUCTION ROUTE CARD

PART NO 16120-2
ASSEMBLY NAME Side Panel Assy. - MPES

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 6 OF

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER MH	MANHOURS OPER TOOL	MANHOURS INSP MH	MANHOURS INSP TOOL	SIGN OFF OPER	SIGN OFF INSP
QC	95	Verify above.						
PA	100	Clean Core pieces (-27,-29 & -31) by immersing in MEK and allowing to drain dry. Wrap pieces in Kraft paper. Handle with clean white cotton gloves.						
QC	105	Verify above.						
PA	110	Clean bonding fixture with Kimwipe saturated with MEK. When dry, appl mold release compound to required areas.						
PA	120	Remove adhesives (R-393-1 & R 379-B) from freezer. Allow to thaw before unrolling to avoid cracking. NOTE: Clean white cotton gloves required for the following operations 130 thru 140. NOTE: Q.C. witness oper. 130.						
PA	130	Cut pieces of adhesive R-393-1 to match each skin and each doubler. NOTE: ADHESIVE MAY BE PIECED TOGETHER IF NEEDED, BUT JOINT SHOULD BE TIGHT. LAY UP ASSEMBLY IN THE FOLLOWING ORDER: 1. Place -25 Forward Doubler in position over .012 Brass Shim, prime side up. 2. Place -24 Corner Doubler in position prime side up. 3. Place -19 Upper Doubler in position, prime side up.						

STEWART AIRCRAFT ENGINEERING CORPORATION
a LATTY INDUSTRIES Company

PRODUCTION ROUTE CARD

ASSEMBLY PART NO 16120-2
ASSEMBLY NAME Side Panel Assy. - MPES

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 7 OF

DEPT	OPER	OPERATIONS INSTRUCTION	OPERATOR	MANHOURS OPER HR	MANHOURS OPER TOOL	MANHOURS INSP HR	MANHOURS INSP TOOL	SIGN OFF OPER	SIGN OFF INSP
PA	130	Continued							
		4. Peel backings from R-393-1 film adhesive pieces that were pre-cut and place on each of the three doublers.							
		5. With Upper Spacer in correct position on fixture, place -14 skin in position.							
		6. Peel backings from R-393-1 film adhesive piece pre-cut and place on top of skin.							
		7. Pre-assemble -34 Dog Bone to -35 Forward Frame with MS27039-1-18 Screw and place in position.							
		8. Place -39 Upper Frame in position and secure it and Dog Bone to fixture with #6-32 screws.							
		9. Place -18 Rail in position.							
		10. Place -38 Bottom Frame in position and secure to fixture with #6-32 screws.							
		11. Cut R-370-B foaming adhesive into strips approximately 1/2" wide. Apply these strips to inside edges of Rail and all frame members.							
		12. Place Core pieces into position.							
		13. Wrap each -15 Insert with strip of R-370-B adhesive and place insert into position in Forward Core.							
		14. Peel backings from R-393-1 film adhesive pre-cut and place in position on top of assembly.							
		15. Place -12 skin on top of assembly.							
		16. Peel backings from R-393-1 film adhesive pre-cuts and place in position on skin.							
		17. Place -25 Forward Doubler in position primed side down.							
		18. Place -22 Corner Doubler in position, primed side down.							
		19. Place -19 Upper Doubler in position, primed side down							
		20. Make up test coupons and place in position on fixture.							
QC	135	Verify operation 130.							

STEARNS AEROSPACE PRODUCTS CORPORATION
a TALLEY INDUSTRIES Company

PRODUCTION ROUTE CARD

ASSEMBLY NAME: Side Panel Assy. -MPES

JOB ORDER NO.

PRODUCTION ORDER NO.

SHEET 8 OF

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER TOOL	MANHOURS INSP HR	MANHOURS INSP TOOL	STAMP OPER	STAMP INSP
		OPERATION						
PA	140	Verify dowel pin holes are aligned. Place upper and lower clamp plates on fixtue. Put 1/8" dia x 1 1/2" wooden dowels in place. Verify that fixture spacer plates are seated between Doublers and not riding on edge of Doublers. Assemble clamp bolts and tighten uniformly.						
QC	145	Verify above.						
PA	150	Attach thermocouple leads and place loaded fixture in oven. Set oven thermostat for 250°F. to 260°F.						
T&A	160	Monitor temperature and notify assembly personnel when 60 minutes at 250°F. has elapsed. Provide strip recorder print-out and attach to this PRC.						
QC	165	Verify above.						
PA	170	Remove from oven and allow to air cool. Disassemble fixture and remove bonded assy. Hold test coupons for QC disposition.						
PA	180	Locate and mark holes for rivets thru rail. Drill each with #21 drill. Assemble rivets, MS20470-AD5, head out, and set.						
PA	190	Install (1) Heli-Coil, MS21209-F4-20, wet with primer, into lower Boss						

STEWART AERO ENGINEERING CORPORATION
a LATTY INDUSTRIES Company

PRODUCTION ROUTE CARD

PART NO 16120-2
ASSEMBLY NAME Side Panel Assy. - MPES

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 9 OF

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER TOOL	MANHOURS INSP HR	MANHOURS INSP TOOL	SIGN OFF OPER	SIGN OFF INSP
QC	195	Verify above.						
PA	200	Mix R-371 Edge Filler with catalyst per manufactuers instructions. Fill exposed edges at front and top of panel. After 8 hrs. cureing, sand smooth. Breal sharp edges as required.						
QC	205	Final Acceptance: 1. Verify all operations completed. 2. Verify test coupons as required. 3. Verify parts conform to drawing requirements. (See Note, Pg. 1 of this PRC).						
PC	210	Hold for next assy.						

a BATTEY INDUSTRIES Company

PRODUCTION ROUTE CARD

JOB ORDER NO. _____ PRODUCTION ORDER NO. _____ SHEET 1 OF 5

ASSY ART NO	16130-1	DWG REV --	LOT NO
DESCRIPTION	Seat Pan Assy. - MPES		QTY PER W O
			QTY ACCEPT
NEXT ASSY ART NO	16100	QTY PER NEXT ASSY 1(-1)	QTY REJECT
ASSY SERIAL NO(S)			
EFFECTIVITY			
NOTES			

PREPARED J. Enloe DATE 4/3/80

APPROVED SYS. _____ DATE _____

Q.A. [signature] DATE 4-3-80

REVISIONS

PRC REV	DWG REV	REASON FOR CHANGE	OPERATIONS AFFECTED	DATE	PREP BY	APPR BY

DATE W O ISSUED		REQ COMP DATE	
ISSUED BY		RECEIVED BY	
DATE W O RECD		DATE W O COMP	
ACCEPTED (QC)		ACCEPTANCE DATE	
TOTAL TIME		UNIT TIME	

ASSEMBLY/PARTS LIST PARTS ISSUED BY _____

ITEM NO	QTY ASSY	QTY W O	QTY ISS'D	DATE / BY	PART NUMBER	REV	PART NAME/MATERIAL	MATERIAL SIZE	MATERIAL SPEC	RAW MATL /CERT NO
	1				-11		Skin, Lower			
	1				-13		Skin, Upper	(Both parts are	identical prior	to bonding)
	1				-15		Core			
	18				-17		Inserts			
	AR						Adhesive (R-393-1)			
	AR						Adhesive (R-370-B)			
	AR						Primer (R-500)			
	AR						Edge Filler (R-371)			

111AD907-258 SHEET 1 OF 3

C-34

NADC-80208-60

PRODUCTION ROUTE CARD

ASSEMBLY NAME: Seat Pan Assy. - MPES

JOB ORDER NO.

PRODUCTION ORDER NO.

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER 10th	MANHOURS INSP HR	MANHOURS INSP 10th	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF TIME
PA	10	Prefit skins to fixture to assure correct fit with dowel pins. Steel stamp identify each skin on inner surface in inconspicuous location.							
PA	15	Verify cleaning solutions & temperatures							
PA	20	Clean parts in the following manner: Skins & Inserts 1. Degrease with Kimwipes saturated with MEK. 2. Clean with Oakite cleaner at std. concentration and 140°F. to 150°F. for 10 - 15 minutes. 3. Rinse in cold flowing water for 3 minutes. 4. Check for water break free film. If water break occurs; repeat #2 & #3. 5. Immerse for 10 - 11 minutes in 140°F. to 160°F. solution of of Sulphuric Acidd (32.3 - 40.0 oz. Wt.) and Sodium Dichromate (3.3 - 4.7 oz. Wt.) with water to make one gallon solution. 6. Rinse with cold flowing water for 3 minutes. 7. Check for water break free film. If water break occurs repeat #5 & #6. 8. Rinse with hot flowing water. (approx. 140°F.). (If water break occurs, repeat #5, #6 & #7) 9. Air dry. NOTE: Once cleaning process begins parts must not be touched with bare hands. Use rubber gloves for wet parts. Clean cotton gloves thereafter. 10. Wrap parts individually in Kraft paper.							

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 3 OF 5

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER 10th	MANHOURS INSP HR	MANHOURS INSP 10th	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF TIME
QC	25	Verify above.							
PA	30	Apply R-500 primer to inserts & to numbered side of skins. Primer should be applied .0001" to .0003" film thickness. Allow to air dry 30 min. and oven cure for 30 minutes at 235°F. to 250°F. Upon removal from oven, rewrap in Kraft paper. NOTE: No more than 16 hours should elapse between cleaning and priming.							
QC	35	Verify above.							
PA	40	Clean Core (-15) by immersing in MEK and allowing to drain dry. Wrap pieces individually in Kraft paper. Handle with Clean cotton gloves.							
QC	45	Verify above.							
PA	50	Clean bonding fixture with Kimwipe saturated with MEK. When dry, apply spray-on mold release.							
PA	60	Remove both film adhesives from freezer. Allow to reach room temperature before unrolling. Apply film adhesive (R-393-1) to bottom skin on primed side and trim excess. (Assemble skin to fixture. Cut film adhesive (R-370-8) into strips approx. 9/16 wide. Roll one piece of strip around each Insert (-17) and place insert on dowel pin in fixture. Place core (-15) in position in fixture. Apply film adhesive (R-393-1) to top skin on primed side and trim excess. Assemble top skin in position on top of already							

-Continued-

PRODUCTION ROUTE CARD | NAME Seat Pan Assy. - MPES

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 4 OF 5

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER 10th	MANHOURS INSP HR	MANHOURS INSP 10th	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF TIME
PA	60	Continued assembled parts. Prepare test coupon and place on fixture alongside -1 assy. Place top Plate on bonding fixture, secure with bolts and tighten uniformly. NOTE: UNTIL FIXTURE IS CLOSED CLEAN COTTON GLOVES MUST BE USED.							
QC	65	Verify above.							
PA	70	Attach thermocouple lead and place loaded fixture in oven to cure at 250°F. to 260°F.							
T&A	80	Monitor temperature and notify assembly personnel when 60 minutes at 250°F. has elapsed. Provide strip recorder printout and attach to this P.R.C.							
QC	85	Verify above.							
PA	90	Remove from oven and allow to air cool. Disassemble fixture and remove bonded assy. Hold test coupon for Q.C.							
PA	100	Hand file 45° x .31 notch .75 wide (2) places at rear of assy. Collapse Core in that area to allow room for edge filler.							
PA	110	Mix Edge Filler (R-371) according to manufacurers instructions and fill exposed edges around seat pan. Allow to cure and shape smooth.							

a TALLY INDUSTRIES Company

PRODUCTION ROUTE CARD

ASSEMBLY NAME: Seat Pan Assy - MPES

JOB ORDER NO.

PRODUCTION ORDER NO.

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER TOOL	MANHOURS INSP HR	MANHOURS INSP TOOL	SIGN OFF OPER	SIGN OFF INSP	TIME
		OPERATION							
QC	115	FINAL ACCEPTANCE: 1. Verify all operations completed. 2. Verify test coupon as required. 3. Verify parts conform to drawing requirement.							
PC	120	Hold for next assy.							

NADC-80208-60

ASSY PART NO 16100-1 | DWG REV B | LOT NO | QTY PER W O | QTY ACCEPT | QTY REJECT

DESCRIPTION: Front Panel Assy-MPES

NEXT ASSY PART NO 16100 | QTY PER NEXT ASSY 1(1)

ASSY SERIAL NO(S)

EFFECTIVITY

NOTES: Holes around periphery of panel will be located from adjoining members. Heli-Coils, (MS21209-ET420) will be installed at that time.

DATE W O ISSUED		REQ COMP DATE	
ISSUED BY		RECEIVED BY	
DATE W O RECD		DATE W O COMP	
ACCEPTED (QC)		ACCEPTANCE DATE	
TOTAL TIME		UNIT TIME	

PREPARED Don Wilson DATE 4-1-80

APPROVED SYS. DATE

Q.A. DATE 4-1-80

REVISIONS

PRC REV	DWG REV	REASON FOR CHANGE	OPERATIONS AFFECTED	DATE	PREP BY	APPR BY
A	B	Added Ribbon direction for -15	N/A	4/80	JE	4-80

ASSEMBLY/PARTS LIST PARTS ISSUED BY

ITEM NO	QTY ASSY	QTY W O	QTY ISS'D	DATE / BY	PART NUMBER	REV	PART NAME/MATERIAL	MATERIAL SIZE	MATERIAL SPEC	RAW MATL/CERT NO
1	1				-11		Face Sheet, FWD			
2	1				-13		Face Sheet, AFT.			
3	1				-15		Honey Comb Core			
4	1				-17		Frame Bottom			
5	1				-19		Frame Top			
6	1				-21		Frame L.H.			
7	1				-22		Frame R.H.			
8	AR				R-393-1		Adhesive, Structural			
9	AR				R-370-B		Adhesive, (-.100)			
10	AR				R-500		Primer			

PRODUCTION ROUTE SHEET | PART Front Panel Assy

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 2 OF 5

DEPT	OPER	OPERATION'S INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER 10th	MANHOURS INSP HR	MANHOURS INSP 10th	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF TIME
P.A.	10	With skin (-13) in place, locate and fit frame members (-17,-19,-21 & -23) in bonding fixture. Steel stamp identify members for future assy. With transfer punch, mark location of attach holes from bonding fixture. Drill and tap #6-32X, two places on each frame member. (Note: tapped holes are for temporary use in fixture and are in proper location. These holes will later be obliterated by Helicoil tap - See Note Pg. 1.)							
P.A.	20	Fit and identify skins (-11 &-13) with steel stamp in inconspicuous location.							
Q.C.	25	Verify cleaning solutions concentrations and temperatures.							
P.A.	30	Clean parts in the following manner: Skins & frame members- 1. Degrease with Kim wipes saturated with MEK. 2. Clean with Oakite cleaner at std. concentration and 140 to 150 F. for 10-15 minutes. 3. Rinse in cold flowing water for 3 minutes. 4. Check for water break free film. If water break occurs, repeat #2 & #3. 5. Immerse for 10-11 minutes in 140°F to 160 F solution of Sulphuric Acid (32.3 40.0 oz. wt.) and Sodium Dichromate (3.3 - 4.7 oz. wt.) with water to make one gallon solution. 6. Rinse with cold flowing water for 3 minutes.							

NADC-80308-60

111AD0907-258 SHEET 3

AD-A092 292 NAVAL AIR DEVELOPMENT CENTER WARMINSTER PA AIRCRAFT --ETC F/6 1/3
DESIGN, FABRICATION, AND TESTING OF THE MAXIMUM PERFORMANCE EJE--ETC(U)
NOV 80 T J ZENOBI, W C WARD

UNCLASSIFIED NADC-80208-60 NL

2 of 2

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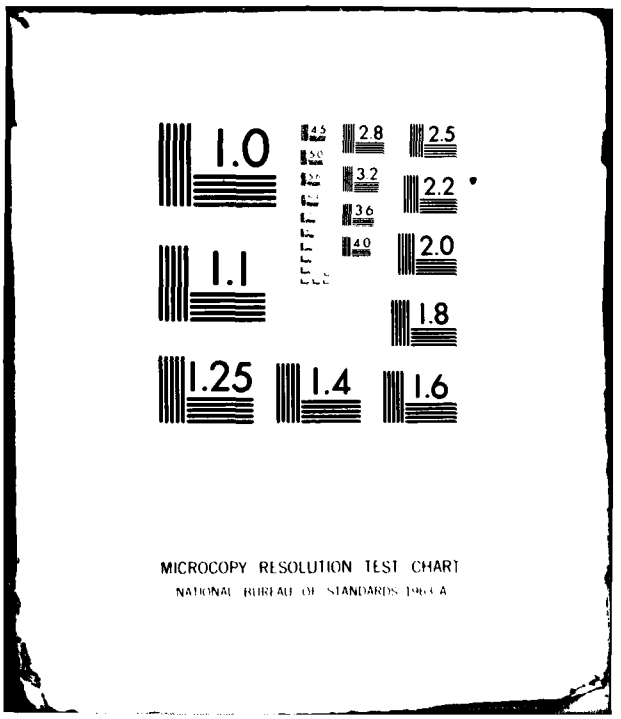
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SPERICAL AERO ENGINEERING CORPORATION
a TALLY INDUSTRIES Company

PRODUCTION ROUTE CARD

SSI PART NO 1616
ASSEMBLY NAME Front Pan ssy.

JOB ORDER NO. PRODUCTION ORDER NO. Sh 3 OF 5

DEPT	OPER	OPERATIONS INSTRUCTION		MANHOURS OPER HR	MANHOURS OPER 10th	MANHOURS INSP HR	MANHOURS INSP 10th	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF TIME
		7. Check for water break free film. If water break occurs, repeat #5 &#6.								
		8. Rinse with hot flowing water (approx. 140°F). If water break occurs, repeat #5, #6, & #7.								
		9. Air Dry.								
		NOTE: once cleaning process begins, parts must not be touched with bare hands. Use rubber gloves for wet parts, cotton gloves thereafter.								
		10. Wrap parts individually in Kraft paper.								
Q.C.	35	Verify Above.								
P.A.	40	Mask outer edge of frame members (-17,-19,-21,&-22). Mix according to mfg. instructions and apply Reliabond R-500 primer to frame members and to numbered side of skins. Primer should be applied .0001" to .0003" film thickness. Allow to air dry 30 minutes and cure for 30 minutes at 235°F to 250°F. Upon removal from oven, rewrap in Kraft paper.	oven							
		NOTE: No more than 16 hours should elapse between cleaning and priming.								
Q.C.	45	Verify Above.								

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NADC-80208-60

111AD0907-258 SHEET 3

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 4 OF 5

DEPT	OPER	OPERATIONS INSTRUCTION	MANHOURS OPER HR	MANHOURS OPER 10th	MANHOURS INSP HR	MANHOURS INSP 10th	SIGN OFF OPER	SIGN OFF INSP	SIGN OFF TIME
P.A.	50	Clean Core (-15) by immersing in MEK and allowing to drain dry. Wrap pieces individually in Kraft paper. Handle with cotton gloves.							
Q.C.	55	Verify above.							
P.A.	60	Clean bonding fixture with Kimwipe saturated with MEK. When dry apply spray-on mold release.							
P.A.	70	Remove both film adhesives from freezer. Allow to reach room temperature before urrolling. Apply film adhesive (Reliabond 393-1) to -13 (on primer side) skin and trim off excess. Assemble -13 skin. into bonding fixture. Cut film adhesive #370-B into strips approx. 5/8" wide. Assemble frame members (-17,-19,-21,&-22) into fixture. Secure with #6-32 screws. Apply a strip of #370-B to inner edge of frame members. Assemble core (-15) Apply film adhesive (393-1) to -11 skin (on primed side), trim off excess and place on top of already assembled parts. Prepare test couponand place alongside -1 assembly in bonding fixture. Place top place on bonding fixture, secure with bolts and tighten uniformly. NOTE: Ribbon direction of -15 as shown in drawing NOTE: Until fixture is closed, white cotton gloves must be used.							
Q.C.	75	Verify above.							

SPECIAL AERO ENGINEERING CORPORATION
a FAIRLY INDUSTRIES Company

PRODUCTION ROUTE CARD

SSI
PART NO 16160-1
ASSEMBLY NAME Front Panel Assy

JOB ORDER NO. PRODUCTION ORDER NO. SHEET 5 OF 5

OPERATION			MANHOURS				SIGN OFF		
			OPER		INSP				
DEPT	OPER	OPERATIONS INSTRUCTION	HR	10th	HR	10th	OPER	INSP	TIME
P.A.	80	Attach thermocouple leads and place loaded fixture in oven to cure at 250°F - 260°F.							
T&A	90	Monitor temperature and notify assembly personnel when 60 minutes at 250 F has elapsed. Provide strip recorder readout and attach to this P.R.C.							
Q.C.	95	Verify above.							
P.A.	100	Remove from oven, allow to air cool. Disassemble fixture and remove bonded assy. Hold test coupon for Q.C. Disposition.							
Q.C.	105	Destructively test coupon for peel strength as required.							
		FINAL ACCEPTANCE: 1. Verify all operation completed. 2. Verify test coupon as required. 3. Verify parts conform to drawing requirements. (see note page 1 of this P.R.C.)							
P.C.	110	Hold for next assy.							

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111AD0907-258 SHEET 3

A P P E N D I X D

MPES
SEAT STRUCTURE
ACCEPTANCE TESTS

S T R U C T U R A L T E S T S

INTRODUCTION

The text in this appendix documents the dynamic testing conducted on the MPES seat structure. Four seats were procured from Stencel Aero Engineering Corporation under NADC Contract No. N62269-80-C-0203. Criteria for acceptance of these seats included static application of a 12,600 lb. load on the seat lid and an 8,000 lb. drogue chute bridle pull force on the upper seat back panel. However, in the absence of a feasible cost-effective method of applying the static load, it was decided to base acceptance on dynamic evaluation using the NADC ejection tower facility.

One of the four procured seats was subjected to the dynamic evaluation tests. These tests included two ejection tower tests of approximately 25 G and a drop test which imposed a 5,100 lb. pull force on the seat back panel. These tests reflected the maximum capability of the test facility, and although they did not impose the loads specified in the seat acceptance criteria, they were still severe enough to expose any gross weakness in the structural integrity of the seat structure.

SUMMARY OF RESULTS

The tested seat (S/N0001) successfully withstood all dynamic structural tests as established by NADC engineering personnel. There was no evidence of any structural failure or approach to failure on any portion of the seat structure.

CONCLUSION

The seats provide enough structural integrity for use on all dynamic testing of the MPES system which has been currently planned.

EJECTION TOWER TESTS

The test seat (S/N 0001) was modified by the addition of an inertia reel, lap belt retraction/release mechanisms for lower torso restraint, headrest, seat cushion, back cushion, and the addition of 55.5 lbs. of lead ballast. The ballast duplicated the anticipated weights of heavy seat components which impose stresses on the seat structure during high acceleration. The seat was mounted to an adapter plate such that total ejection force was directed into the catapult attachment fittings closely replicating actual ejection conditions. A 95 percentile dummy weighing 250 lbs. was installed in the seat and the system installed on the ejection tower (See Figure D-1). Instrumentation was provided to measure catapult pressure, seat acceleration parallel to rails, and dummy chest accelerations G_Z and G_X. Strain gages were also placed in selected locations on the seat bucket side panels as shown in Figure D-1. The results of the ejection tower tests are given in Table D-I. The maximum strain was measured on the uppermost gage shown in Figure D-1. Strain on the uppermost and middle gages was due to tensile stress. The bottom gage was subjected to compressive stresses. A maximum strain of 3.882 micro-inches/inch was achieved on Test No. 3. This strain corresponds to a tensile stress of 41,149 psi

Figure D-1- Ejection Tower Test Configuration

which is approximately 60% of the yield strength of the local material (Al-7075-T6).

Table D-I Ejection Tower Test Results

Ejection Test No.	Seat Wt. (lbs.)	Dummy Wt. (lbs.)	Seat Acceleration (G's)	Max Measured Strain	Calculated Stress (psi)	% Yield Stress
1	125	231	16.5	2.057	21,840	33%
2	125	231	24.3	3.616	38,300	58%
3	125	231	25.0	3.882	41,149	62%

Test Date: 13 June 1980

DROGUE CHUTE BRIDLE PULL FORCE TEST

This condition was established to duplicate the load imposed by the drogue parachute opening shock transmitted through the drogue bridle release mechanism into the seat structure back panel. The same seat/dummy configuration as used in the ejection tower tests was used for this test. Redundant restraints were added for restraining the upper and lower torso to insure that the dummy load would still be transmitted into the seat structure and that the dummy and instrumentation in the dummy would not be destroyed if the primary restraint failed. The seat/dummy combination was dropped from varying heights into straps which terminated in a single fitting retained by a shackle release pin. Figures D-2 and D-3 show the test configuration. A series of three drop tests was conducted with the maximum riser/seat reaction force of 5,104 lbs. being attained. The results of these tests are presented in Table D-II.

Table D-II Dynamic Pull Force Test Results

Drop Test No.	Seat/Dummy Drop Weight (lbs.)	Max. Total Seat Deceleration (G's)	Max. Total Dummy Deceleration (G's)	Riser/Seat Reaction Force (lbs.)
1	370	11.40	12.0	2506
2	370	16.85	22.1	4713
3	370	21.92	--	5104

Test Date: 7 August 1980

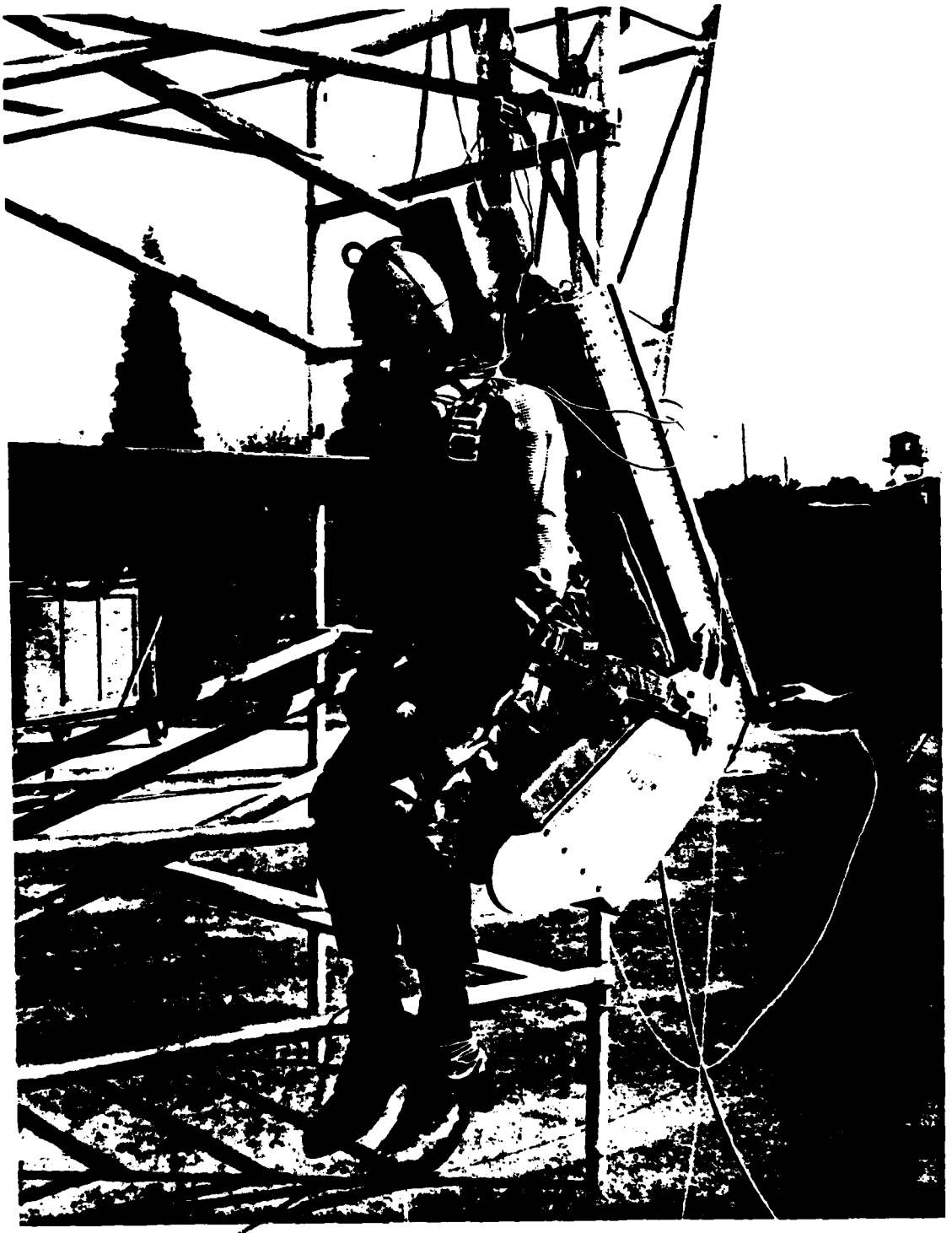

Figure D-2- Pull Force Test Configuration

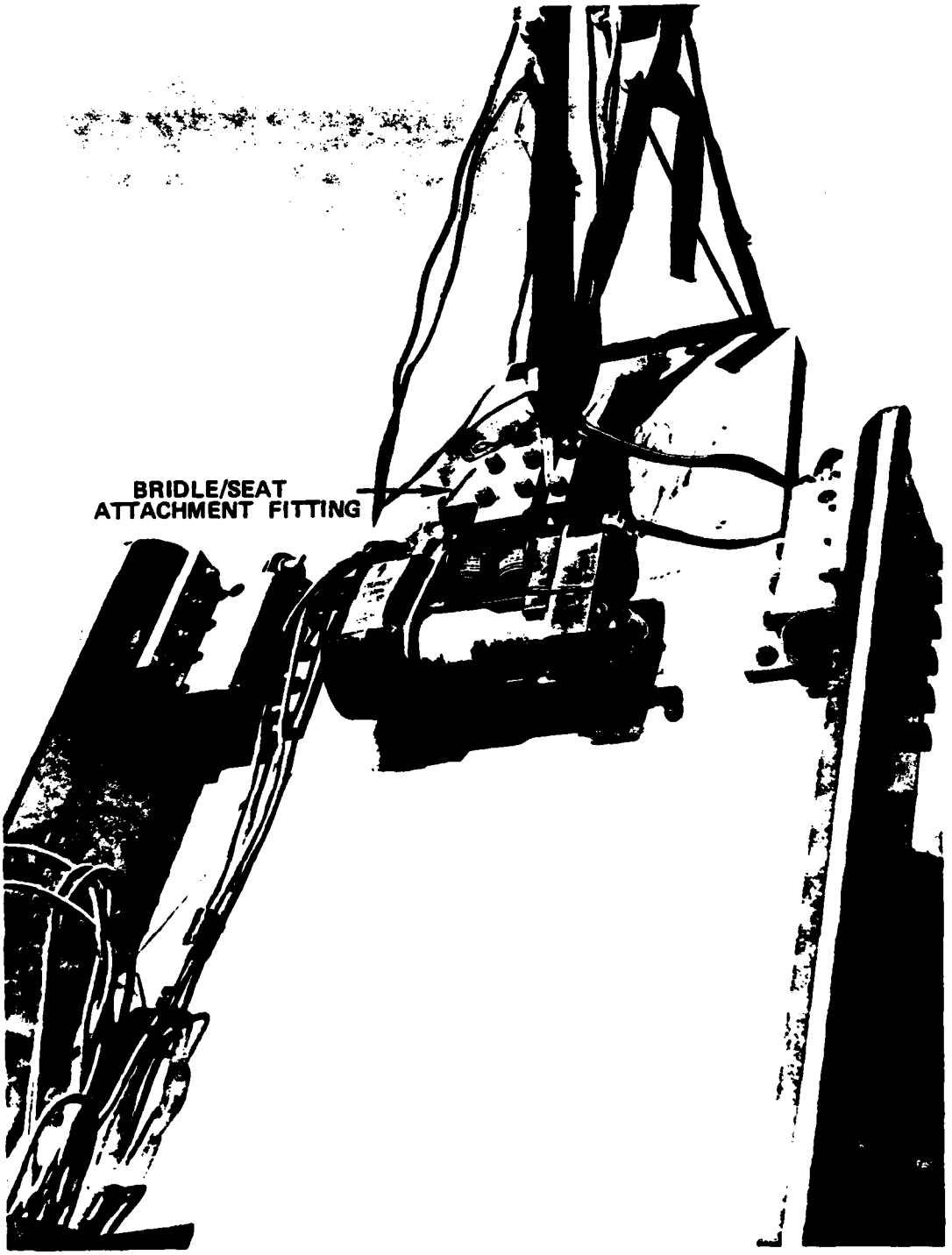

Figure D-3- Bridle/Seat Attachment Fitting Location for Pull Force Test

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